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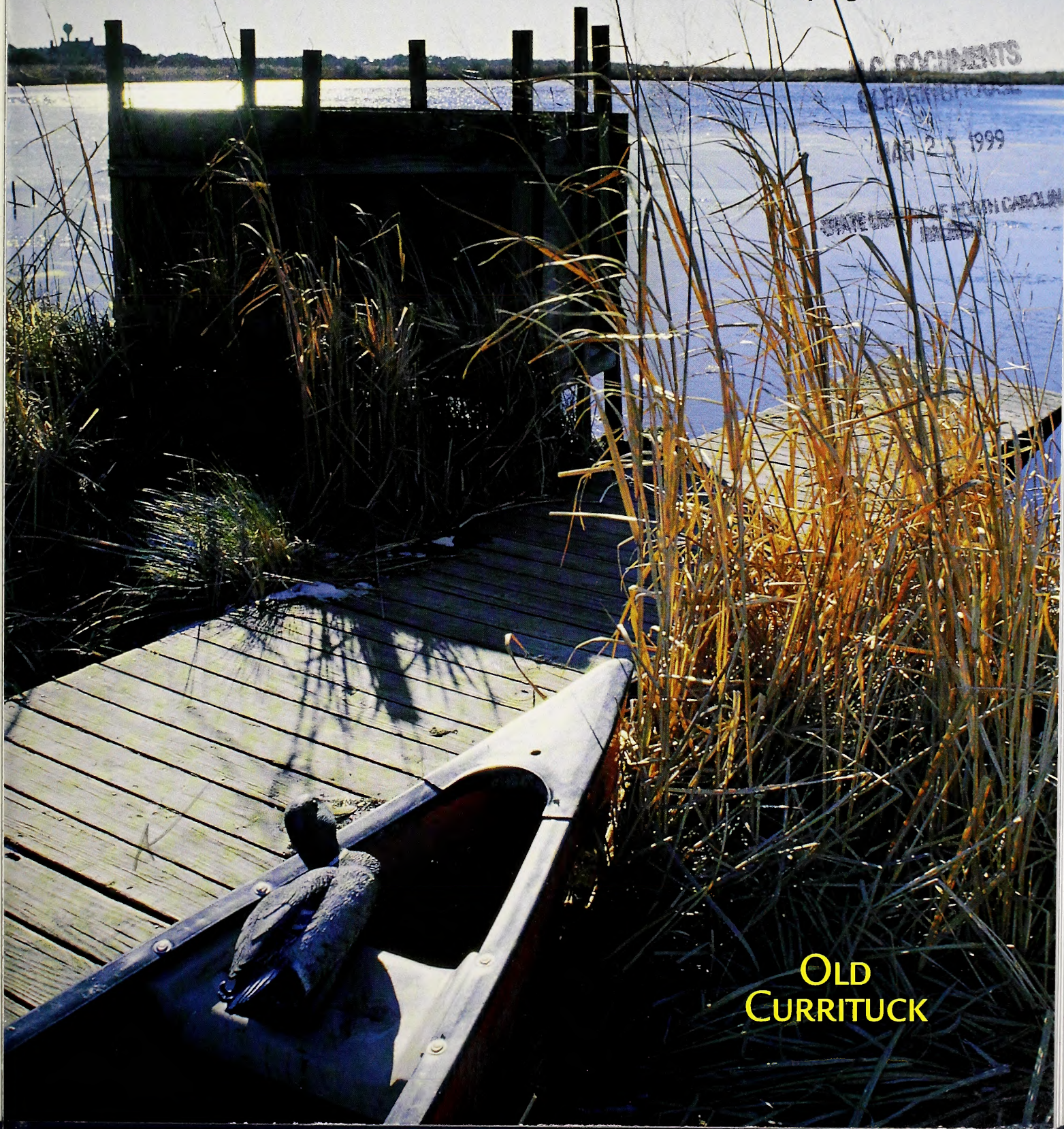
Blackbeard's Flagship? • Rebirth of the Chowan • Giant Tuna

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Coastwatch

North Carolina Sea Grant

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MARINE

OLD
CURRITUCK

From the Editor

Spring Field Trips

Ah, spring.

Even though we had hints of warm weather back in January, most of us can't wait for the real thing — getting home before dark, with time to take a walk or work in the yard.

The warm weather undoubtedly brings plans for an excursion to the coast. When you visit our sandy shores or coastal plain, I hope you'll take time to appreciate the history that surrounds you. This issue of *Coastwatch* offers perspectives to ponder during your next visit to the Currituck Banks, Beaufort or Edenton.

T. Edward Nickens takes readers to Old Currituck. He finds Roy Saunders Sr., who at age 92 is one of the few people left with memories of the market hunting era that ended in the 1910s.

Has the *Queen Anne's Revenge*, Blackbeard's flagship that ran aground in 1718, been found off Beaufort? Julie Ann Powers takes readers into the realm of underwater archeology and artifact conservation as historians try to document the identity of the ship found in just 20 feet of water.

A more modern — and environmental — history lesson can be learned by visiting the Chowan River in northeastern North Carolina. Barbara Doll and Renée Wolcott Shannon look back at the cooperative efforts between state water quality regulators, Sea Grant researchers and community volunteers to determine the level — and effect — of nutrients flowing into the river.

Of course, not all lessons at the coast involve history. The arrival of 600-pound bluefin tuna off Cape Lookout has meant an expansion of the Tag-a-Giant research efforts to gather migration information on these giant fish.



Herman Lankford

Andy Wood teaches thousands of children each year through his role as education curator at the N.C. Aquarium at Fort Fisher. But Wood also finds himself teaching — and at times preaching — environmental lessons to anyone who will listen, as Odile Fredericks shows us.

Also, Shannon offers a suggested reading list for armchair sailors. And finally, Kathy Hart provides recipes that will bring back memories of your first attempt to pick delicate meat from the shells of blue crabs.

On a more somber note, the North Carolina Sea Grant family mourns the death of Ruthie Hodson, wife of our director, Ron Hodson.

Ron and Ruthie were passengers in a small plane that crashed Jan. 30 in Florida. Ron suffered serious injuries, but he is regaining strength day by day. We hope he will return to the office this spring.

As a new member of the Sea Grant team, I had felt Ruthie's welcoming nature. Veteran staff members have countless stories of her kind and gracious acts, of how her smile could brighten a room.

A memorial fund has been established in her honor. Contributions may be made to:

*Duke University Fibromyalgia Research
Ruth E. Hodson Memorial Fund
PO Box 90581
Durham, NC 27708*

Our office has received many calls and e-mails offering support to Ron and his son, Todd. We have shared these messages with Ron, who offers thanks for the outpouring of encouragement from researchers, the aquaculture community, friends and colleagues. ▣

Katie Mosher, Managing Editor

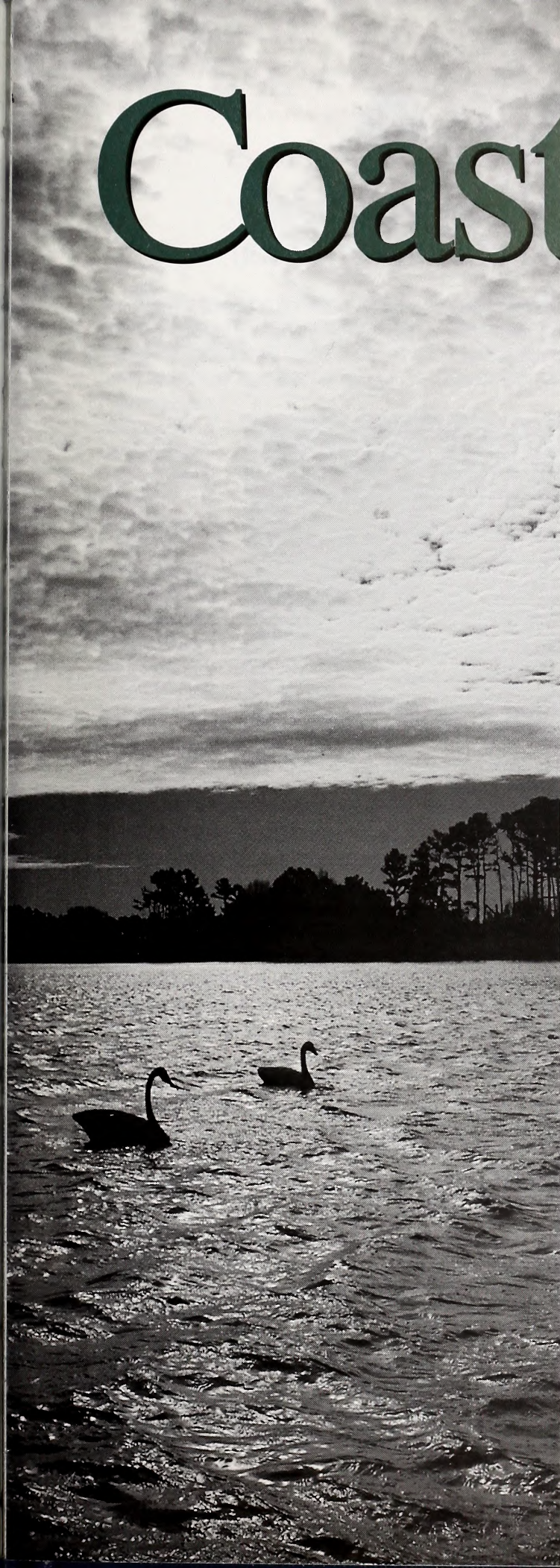
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Coastwatch

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Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports several research projects, a 12-member extension program and a communications staff. Ron Hodson is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina. *Coastwatch* (ISSN 1068-784X) is published bimonthly, six times a year, for \$15 by the North Carolina Sea Grant College Program, North Carolina State University, Box 8605, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095. E-mail: kmosher@unity.ncsu.edu. World Wide Web address: http://www2.ncsu.edu/sea_grant/seagrant.html. Periodical Postage paid at Raleigh, N.C.

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Front cover photo of boat and decoy
by Scott D. Taylor.

Table of contents photo of Currituck Sound
by Scott D. Taylor.

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COASTAL TIDINGS

Database to Reflect Power of Hurricane Fran

The legacy of Hurricane Fran lives on. Spencer Rogers, North Carolina Sea Grant's coastal construction and erosion specialist, is working with state and federal agencies to develop a comprehensive data bank on the September 1996 hurricane, which is considered a 100-year storm-surge event.

The extensive database will provide wide opportunity for analysis. For example, researchers can determine the success of beach nourishment efforts by comparing damage in those areas to damage sustained outside the nourishment zone.

"In the past we have done a better job of looking at individual buildings, what happened to them and why," Rogers says. "We have not done as good a job of looking at what happened at a community level and why."

Rogers is collaborating with many agencies to develop the data bank, including the mapping lab at the North Carolina State University Department of Civil Engineering,

the N.C. Division of Coastal Management, the Federal Emergency Management Administration's hazard mitigation grant program, the National Oceanic and

Atmospheric Administration's Coastal Services Center and the U.S. Army Corps of Engineers.

Damage statistics are being gathered for erosion, overwash and flood zones. Within these

zones, damage assessments will include data such as building location, size, value, age and foundation type.

"We will have flood insurance claims of actual damage from a 100-year storm surge that should have been handled by current construction codes. These reports will show the real cost to the flood insurance program and to the public," Rogers says.

"Fran's sustained wind speeds in most of the developed areas were less than 110 miles per hour and thus did not provide a full test of the 50-year wind standard used in the building code." — K.M.

Lundie Spence



Topsail Island felt Fran's fury.

In the Next Issue of *Coastwatch*

In the next issue of *Coastwatch*, Julie Ann Powers takes you to Portsmouth — the biggest and busiest town on the Outer Banks for decades after its founding in 1753. But Portsmouth's fortunes ebbed with the whims of the sea. Today, the remote village on Cape Lookout National Seashore is preserved as a testament to island life. Occupied now only by memories, Portsmouth whispers its history in the sweep of the wind, the murmur of the distant surf and the creak of every rusted door hinge.

And while you may have visited an aquarium or two, have you ever been to an estuary? Ann Green will take you to the North Carolina Estuary operated by the Partnership for the Sounds.

Citizen Research through Fishery Resource Grants

People who work the water for a living often have the best ideas for improving fisheries resources — developing better gear, protecting habitat, or testing innovations in aquaculture or seafood technology.

Rarely do these people have the time and money to pursue their ideas ... unless, of course, they live in North Carolina.

The N.C. Fishery Resource Grant Program, administered by North Carolina Sea Grant and funded by the N.C. General Assembly, invests in the ideas of the people who work in fishing industries.

This year, applicants proposed 57 projects. In March, the N.C. Marine Fisheries Commission (MFC) is expected to select those projects to be funded in 1999.

The innovative program allows a natural pairing of expertise and ideas. Sea Grant specialists and agents hold workshops and work one-on-one with applicants to help develop ideas into projects that can produce meaningful, quantifiable results. In its four-year history, the program has yielded marketable innovations such as scallop medallions that are molded from scallop fragments without precooking or freezing. Other projects examine environmental impacts of human activities, such as the effect of bottom trawling or the removal of a dam on fish migration.

Sea Grant organizes both in- and

out-of-state reviews of all applications before the MFC considers them. Funding is provided by the N.C. General Assembly, which has pledged \$1 million

Skip Kemp



One 1998 study examined hard clam growth and survival.

among fellow fishers, the MFC and academic institutions.

Ultimately, the citizen research yields information about North Carolina's fisheries and shows how these resources can be used and managed more effectively.

Pending approval by the MFC, a video explaining how to apply for a Fishery Resource Grant will be available soon through North Carolina Sea Grant and the Division of Marine Fisheries. The video, a Bill Hitchcock production, will be shown on "North Carolina Saltwater," a weekly magazine-style television show about the North Carolina coast, and on the World Wide Web at <http://www.ncsaltwater.com/>.

Sea Grant specialists are also available to discuss the program — how to apply or to review completed projects. Call Sea Grant's Raleigh office at 919/515-2454 or its field offices in Wilmington (910/256-2083), Morehead City (252/247-4007) and Nags Head (252/441-3663).

annually since it established the program in 1994. To date, more than 140 projects have been funded.

When the projects are completed, the researchers are required to share their findings

AROUND THE NETWORK:

Seeing the Sounds of Silence: Marine Sciences for the Deaf

Science scores are generally lower for deaf students than their hearing counterparts. Connecticut Sea Grant aims to change that.

In a project funded by Sea Grant, Pete Scheifele, director of marine education programs for the National Undersea Research Center, North Atlantic and Great Lakes, is working with teachers and students from the American School for the Deaf in Hartford, Conn., to help students learn basic science and math through a hands-on marine science curriculum.

Students are working on a research project in underwater acoustics, learning to use sonar technology to distinguish ambient noises in Long Island Sound and the Gulf of Maine from the sounds of aquatic animals and human activities. They "hear" the sounds by studying computer printouts representing the sounds' wave-forms.

Scheifele says deaf students tend to have lower science scores because "there are no signs in American Sign Language for scientific terms, so each term must be spelled out letter by letter. It takes the deaf person about three times longer to absorb the same material as the hearing student."

Scheifele aims to address the problem by working with a high school science teacher and an audiologist to put together a book of new scientific signs.

—J.F.N.

Uncovering Croatan Artifacts

AROUND THE NETWORK:

Researchers Develop Diet for Larval Cod

Since hatchery-raised baby cod are no bigger than eyelashes, their menu is rather limited. Even brine shrimp and rotifers, microscopic aquatic animals, are too large for them to eat.

With Maine/New Hampshire Sea Grant support, researchers at the universities of New Hampshire, Maine and Rhode Island have developed artificial foods acceptable to cod larvae. Linda Kling, a University of Maine professor, and Michael Opitz, a Cooperative Extension veterinarian, conducted the research.

"We tested four experimental diets and one commercial food," says Kling. "One of the four does look promising."

Diet has proven to be a major obstacle to successful cod aquaculture in New England. When cod eggs hatch, the tiny larvae draw on their yolk sacs for energy. In the wild, when the sacs are depleted, the young fish eat tiny marine organisms called zooplankton. However, zooplankton are difficult to raise in a hatchery.

In 1997, Kling and Opitz received a \$477,000 federal grant from the National Oceanic and Atmospheric Administration to develop commercial methods for raising cod and haddock in aquaculture pens. Both cod and haddock, which are found from Maine to New Jersey, are severely depleted in the Gulf of Maine.

— A.G.

During an archaeological dig in Buxton, East Carolina University researchers unearthed a 16th-century gold signet ring that links the Croatan Native Americans to the Roanoke Island settlement.

Recently, the ECU team found the ring — encrusted with a lion — on a site occupied by the Croatans during the 17th and 18th centuries.

"This ring is significant because it is the first time we have tied the Croatans to Roanoke Colony," says David Phelps, director of ECU's Coastal Archaeology Office. "The Croatans were the only Indian allies of the English settlers at Roanoke Island. Since gold was not traded in the Indian network, someone gave the ring to the Croatans."

Photo courtesy of East Carolina University



This elaborately decorated cooking pot was found at the Croatan site.

This excavation is part of an ongoing Croatan project that began in 1997. During the latest dig, researchers found evidence that the earliest occupation of the site dates back 2,000 years — about the time of Christ. They also uncovered artifacts from a Native American workshop active during the 17th and 18th centuries —

from three hearth fires with English coins to a ceramic cooking pot.

"This link shows Croatan Indians adapted to European technology," says Phelps. "They converted from bows and arrows to muskets."

The public will be able to view some of the artifacts at museum exhibits planned this year in North Carolina. — A.G.

Fish Stocks on the Mend

The National Marine Fisheries Service is increasing efforts to correct overfished conditions and better protect many important fisheries, according to Terry Garcia, U.S. Department of Commerce assistant secretary for oceans and atmosphere.

Under proposed amendments to the existing law, the service will take steps to manage marine fish stocks more effectively and protect fish habitats across the country.

Fishery officials believe the goals of the Sustainable Fisheries Act's new management strategy also will result in bycatch reduction and more environmentally friendly fishing practices.

"Fishermen, their communities and all who are concerned with conservation are relying on us to succeed," says Garcia,

who is also a National Oceanic and Atmospheric Administration deputy administrator. "The Sustainable Fisheries Act represents a major policy shift by the federal government to ensure that we achieve the greatest long-term benefits to the nation from our fishery resources."

The act was mandated by the 1996 reauthorization of the nation's primary fisheries law, the Magnuson-Stevens Fishery Conservation and Management Act.

Under the plan, the managers of the eight regional fishery management councils are drafting amendments to the existing management plans. North Carolina is represented on the mid-Atlantic and south Atlantic councils. The agency will review the amendments by the end of July.

— A.G.

N.C. Aquariums Expanding

Want a close-up view of reef fishes swimming along a re-created *USS Monitor* shipwreck in a 180,000-gallon ocean tank? How about examining sea stars, rays and urchins?

These aquatic animals will be featured in the newly renovated N.C. Aquarium at Roanoke Island, scheduled to re-open in spring 2000. The Roanoke aquarium and the two other aquariums will double their size and expand their educational efforts, thanks to a \$32 million appropriation from the N.C. General Assembly.

The renovated 70,000-square-foot facility at Roanoke Island will feature the "Waters of the Outer Banks," highlighting local freshwater, brackish and ocean environments. New and larger tanks will house sharks, barracuda, sea turtles and other marine life found in the Outer Banks' aquatic habitats.

The Fort Fisher aquarium at the mouth of the Cape Fear River, which will not close for renovations, will feature the "Waters of the Cape Fear River System."

Tanks and exhibits will highlight aquatic life found in freshwater rivers, swamps, estuaries and open ocean.

The aquarium's centerpiece is a 180,000-gallon ocean habitat, a two-story tank

offering multilevel views of large sharks, groupers, barracuda and loggerhead turtles swimming around re-created Cape Fear rock ledges.

The Pine Knoll Shores aquarium, which will close this fall for renovations, will feature "Aquatic Life from the Mountains to the Sea." The five North Carolina aquatic zones include mountain streams, piedmont rivers and lakes, coastal plain waters, swamps, marshes and open ocean.

—A.G.

Photo courtesy of N.C. Aquariums



A model of the renovated Roanoke Island Aquarium

Get Wise about Water

Where does drinking water come from? What is an aquifer? How does a septic tank work? Who monitors water pollution?

If you've ever pondered questions like these, North Carolina Sea Grant has a book to help you answer them. The new *Coastal Water Quality Handbook* is a source of information for North Carolina citizens who want to maintain and improve the quality of their coastal waters.

The 72-page book answers many of the questions concerned residents have asked Sea Grant in letters and at public

meetings. Topics include water quality, river and estuarine pollution, the importance of estuarine habitats, water quality and fisheries, seafood safety, coastal drinking water and water treatment, the legal framework for protecting water quality and the actions citizens can take to improve water quality.

Illustrations and a glossary help make unfamiliar terms clear to the lay reader. To order a copy, send a check for \$6 to North Carolina Sea Grant, NC State University, Box 8605, Raleigh, NC 27695-8605. Ask for publication UNC-SG-97-04. —R.W.S.

Fish Sounds

People think of the ocean as a quiet, restful place — but the truth is, it can be downright noisy. Boats, submarines and personal watercraft all make distinctive sounds that the U.S. Navy monitors and classifies. But the world of underwater sound does not stop there.

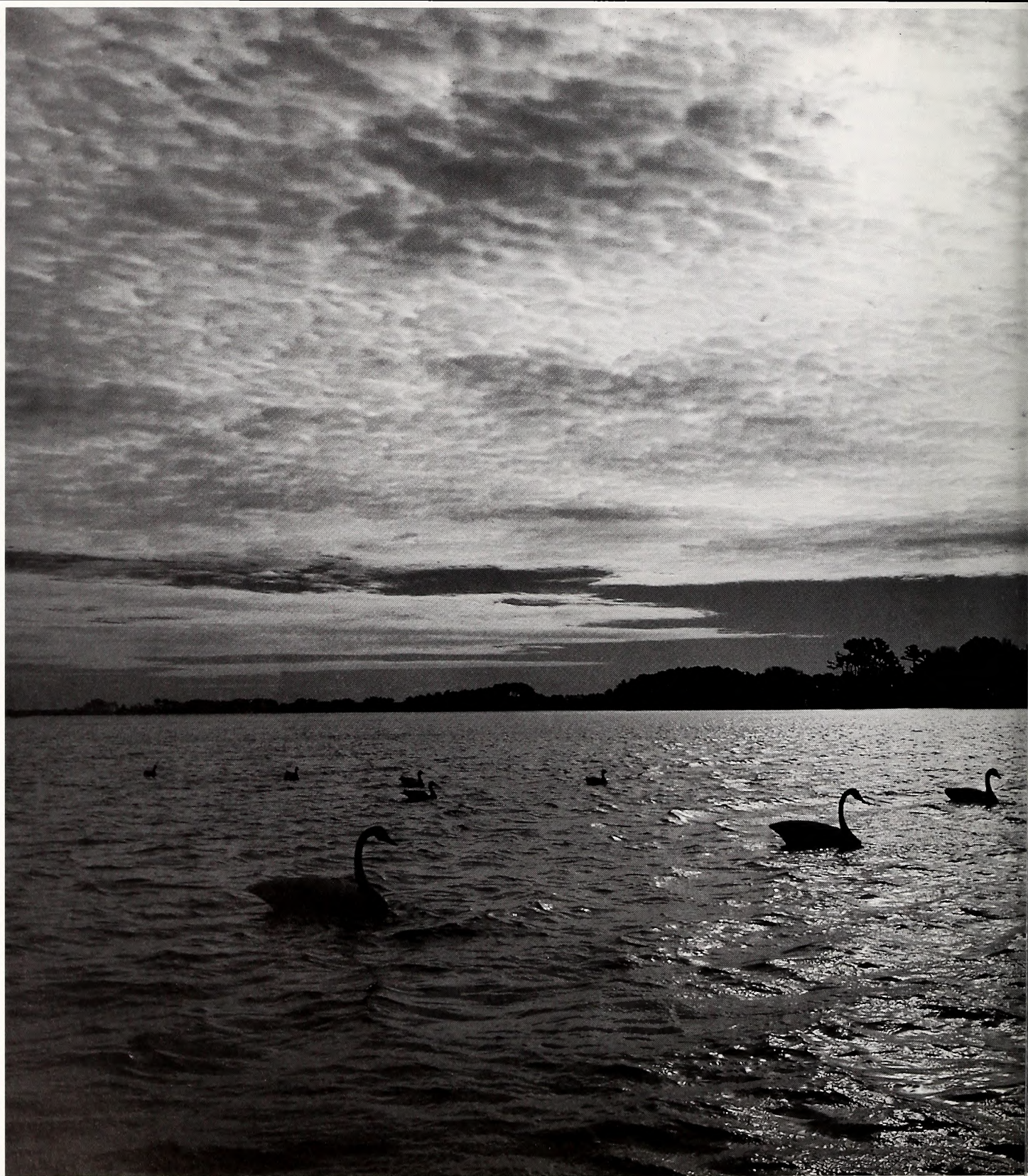
The lonesome songs of humpback whales and the whistles and clicks of dolphins are well-known, but undersea mammals are not the only noisy creatures in the deep. In fact, says Sea Grant fisheries agent Jim Bahen, some anglers can identify fish by their sounds.

White perch and snapping shrimp make loud clicks that are audible through boat hulls. Croaker sound like frogs. Red drum are so called because they make a drumming sound with their air bladders.

Fishers also know that some boats have a particular hum that attracts fish. Large pelagic fish such as tuna and mackerel, though they don't make noises themselves, seem to prefer boats with certain engine sounds and will come up to investigate when they hear them.

Of course, fish don't have ears like ours. Most have bones called otoliths — ear stones — that perceive sound vibrations. Scientists also theorize that fish "hear" sound through their lateral lines. This "sixth sense" is presumed to be what prevents fish from running into one another when they school.

—R.W.S.



Scott D. Taylor

Decoys bob on the waves near Wilson Snowden's blind.



Old Currituck

*Market hunting on Currituck Sound shaped
the people and pride of Currituck country,
as surely as it shaped national conservation policy*

By T. Edward Nickens

It must have been the Christmas of 1911 or 1912 when Santa Claus brought Roy Mervin Saunders Sr. a BB gun. "It was a little Daisy air rifle," Saunders says, sitting in the tidy living room of his small house in Chesapeake, Va., where he has lived for nearly 60 years.

Saunders clutched that prized BB gun with tiny hands as he boated across Currituck Sound, from the Poplar Branch boat landing toward a marshy spit called Red Head Point. His father, Ellie Wilson Saunders, watched over their newfangled one-cylinder Mianus engine. His granddaddy, Daniel Wilson Saunders, kept his hand on the tiller. The boat was hand-built, a semi-deadrise skiff about 21 feet long. It was an unseasonably mild winter morning nearly 90 years ago.

As long as he could remember — which wasn't so very long, for Saunders was not yet 6 years old — he had been at his daddy's heels, begging to go along on a duck hunt. The Saunders men were noted gunners of Currituck Sound, market hunters who killed ducks, geese and swans they then sold to game dealers for shipment to Northern markets.

"At that time, you could kill anything," Saunders explains. "There was no limit whatsoever. You could kill all you could kill, and you could sell 'em." With his BB gun in hand, Saunders was on an adventure he would never forget, his first trip across Currituck.

The wind was light and from the west. Shooting was only fair, Saunders recalls, until the wind rose and shifted to north, and bitter cold bore down on the sound in a weather shift not unknown on Currituck. Then ducks and geese filled the air. Their numbers were startling.

Saunders' father and granddaddy would shoot at as many as three flocks of geese before laying down their guns to collect the birds. Saunders busied himself with his Daisy rifle, but before long he'd run out of BBs and was shivering cold. Ellie Saunders began to worry about the little boy. He hustled him under the bow of the boat and packed dead ducks and geese all around him.

"Then they went back to shooting and kept piling fowl all around me," Saunders says. "Covered me up till I couldn't see daylight, but I could hear, and I could hear 'em shooting." Throughout the long afternoon Saunders waited in a warm chrysalis of dead birds, listening to the boom of his daddy's 12-gauge double-barreled shotgun and the grumbling thunder of his granddaddy's 10-gauge, till darkness silenced them for the day.

As Saunders tells this story he is 92 years old, dressed in plaid pants and a plaid shirt. He gestures vividly — fingers fluttering like ducks raining from the sky, hands holding an imaginary gun to trace a goose's arcing flight. "I'm an odd fellow,"

C o n t i n u e d

Roy Saunders Sr. remembers hunting with his father and grandfather nearly 90 years ago. "At that time, you could kill anything ... There was no limit whatsoever. You could kill all you could kill, and you could sell 'em." Saunders, known for a tack-sharp memory, is one of the few men living who recall firsthand anything at all of the market hunting era that defined Currituck Sound from the 1870s through the 1910s.



Scott D. Taylor

Roy Saunders takes aim with his grandfather's double-barreled shotgun.

he says. "Can't see out of my left eye and can't hear out of my right ear!" Saunders, known for a tack-sharp memory, is one of the few men living who recall firsthand anything at all of the market hunting era that defined Currituck Sound from the 1870s through the 1910s.

For nearly 50 years, this northeastern corner of North Carolina supplied untold numbers of waterfowl and shorebirds — hundreds of thousands, surely; millions, perhaps — to the tables of Norfolk, Baltimore, Philadelphia, New York and beyond. Initially overlooked and overshadowed by the ubiquity of market gunning in the Chesapeake Bay region, the market gunners of Currituck had by the 1910s earned the scorn of the nation's scientific and naturalist communities. As America struggled with the loss of passenger pigeons, the destruction of heron and egret populations for the making of hats and the decimation of buffalo herds, market gunning in Currituck and beyond was held up to the U.S. Congress as an egregious example of the shortcomings of national wildlife policy.

Then, in 1918, the sale of migratory waterfowl was banned. Nearly overnight an enterprise that for a half century supplemented the winter incomes of hundreds of Currituck families vanished. Men who once gunned Currituck Sound for the market turned to guiding for the grand and glitzy duck clubs owned by wealthy Northern businessmen.

Books are plentiful about the duck clubs of the North Carolina coast, but the heritage of commercial waterfowl hunting and the role it played in shaping America's conservation ethic are little considered. Market gunning is known mostly by reputation, a handful of pages in local history books and scratched, blurry photographs that surface in the occasional journal. And it is a story increasingly difficult to tell.

Old duck hunters would have loved the Currituck weather that greets me one howling winter day: skies gray as old fish, winds roaring at 25 mph and raw cold, just a notch or two above the freezing

mark. I hope to find a few men who remember the region's market hunting days, but this is a tall order. Eight decades have passed since market hunting was outlawed, so any memories will be in the heads of Currituckians 90 years old or better. I travel from Corolla to Jarvisburg, to Currituck village and Waterlily. Everywhere I hear a common refrain: *I remember my daddy tellin' me ... No, I wasn't born yet, but ol' man Wright, why, he'd tell us about those days.*

I meet folks like Norris Austin of Corolla, whose daddy was postmaster and whose granddaddy was the last keeper of the Currituck light. Austin remembers his father's tales of killing and shipping ducks, but no, he came along too late to ever see them pack a barrel full of fowl or reload brass shells by lantern light.

There are folks like Walton Carter, down at the Currituck-Knotts Island ferry depot. No, he doesn't remember either, but his mama lived above the old store at Coinjock, and she might have sold market hunters shells or bought ducks a time or two. No, sir, you'll be hard-pressed to find any of those fellows still around.

And they are right. Few firsthand stories can be told of the old market hunting days, and few are as resonant as those of Saunders, entombed in dead fowl and thrilling to a chorus of goose music, wind whining through marsh grass and gun-thunder rolling across the sound.

It would be difficult to imagine a place more providential for waterfowl than Currituck Sound. About 30 miles long, the shallow sound lies north to south, from just across the Virginia state line to the tip of the peninsula that hems in Albemarle Sound. Bounded by the North Carolina mainland to the west and the Outer Banks to the east, it is rarely greater than four miles across. Long ago an inlet cut through the Currituck Outer Banks, and the sound's waters were brine. But drifting sands closed the inlet in 1828. Cut off from direct ocean access, the sound's waters freshened. Oyster beds disappeared, and saltwater fish were wiped out.

In their place, however, came enormous numbers of perch, bass, eels and underwater plains of freshwater plants

relished by waterfowl. The Currituck Sound bottom, reported Alexander Hunter in 1892, was "one mass of wild celery." Untold numbers of wintering ducks, geese and swans piled into the shallow waters — black ducks, pintails, widgeon and teal packing into open marsh ponds, while diving ducks such as canvasbacks, redheads and scaup rafted up by the thousands on the windswept open waters. Stories of duck flocks that darkened the sky are not uncommon, nor far off the mark. Even today, ducks can be so numerous in Currituck Sound that they appear as islands, thin dark smudges against the slate-gray water, until they take wing in cyclonic swarms.

It didn't take long for Currituck farmers to turn to this supply of game for cash money. Edmund Ruffin, a Virginia editor who traveled extensively in the Currituck region in the 19th century, wrote of an Edgar Burroughs who owned a large farm just across the Virginia line. In the mid- to late 1850s, Burroughs hired 30 gunners to hunt from his farm. He sold

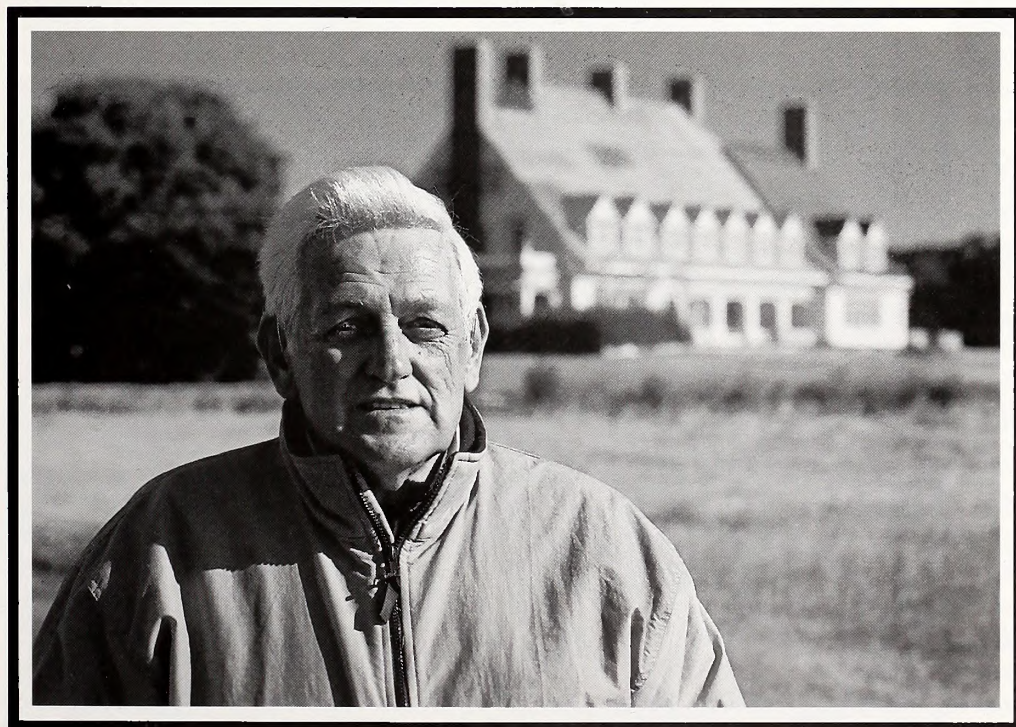
ammunition to the hunters and paid a fixed price for every duck, goose and swan they delivered.

In a single winter his hunters went through 1 ton of gunpowder, 4 tons of lead shot and 46,000 percussion caps. "From this expenditure, along the shore of one large farm only," Ruffin figured, "there may be some faint conception of the immensity of the operations, and the results, along shores extending for full one hundred and fifty miles, and on all of which the same business is regularly pursued."

When the Chesapeake and Albemarle Canal was completed from Currituck Sound to Norfolk in 1859, Currituck gunners gained direct and swift access to Northern markets. Steamers made thrice-weekly runs to formerly remote outposts such as Knotts Island, Poplar Branch and Church Island. By 1861, Ruffin wrote, "the killing of wild water-fowl [in Currituck Sound was] a branch of industry of considerable importance for its amount of profit. Its extent is scarcely known by any person out of this region."

In its infancy, gunning for market in Currituck was a simple affair. "Ducks was shot sitting and at the rise," Henry B. Ansell wrote in his unpublished manuscript, *Tales of Knotts Island*, a recounting of sound life from the 1830s to 1907. "The crawling practice was in vogue. Go into the marsh with noiseless care; look over the coves, creeks and ponds; see if any of the feathered tribe have ventured near enough to shore for a shot; if so, down on hands and knees, often in mud and water; crawl to the water's edge; peep through the marginal marsh or galls; see where ducks were thickest. Ready — aim — bang. Fuss and feathers,

Continued



Norris Austin, whose grandfather was the last keeper of the Currituck light, shares family tales.

what clatter and scramble: There might be three or four or a score of dead and crippled ducks."

In those early years, a waterfowler's gun was most likely an English or French muzzle-loader, a large 10-gauge shotgun fired by flint and steel. Some used much larger firearms — punt guns with barrels 2 inches in diameter, lashed to small skiffs and fired like cannons. The numbers of birds killed with the single blast of such a gun were impressive, but by the late 19th century a tactic had emerged in Currituck that would define waterfowl hunting there for decades: gunning from a floating battery blind, or sinkbox.

The battery was a complicated affair, at its core a shallow rectangular box some 15 inches deep, slanting upward at the head end so a gunner lying prone could barely see all around. This box was attached to horizontal wooden decking on all sides, and large "wings" of woodslat and canvas were hinged, accordion-style, to the decking. Floating in the sound, these wings blunted the action of waves, riding up and over each crest. The battery was painted gray to resemble the water surface.

Using their shad boats or larger vessels, market hunters would sail or motor to the hunting grounds, then lower the battery with a boom and tackle mounted to a mast. Hundreds of decoys were placed around the battery, mostly canvasbacks and redheads. Once the gunner had climbed into the shallow box, battery weights and iron decoys were placed on the wings to settle the blind even lower in the water. The gunner's partner or "pick-up man" waited downwind to retrieve dead birds and aid the gunner if rough weather suddenly appeared.

Even in the best weather, gunning from a "lay-down" battery (deeper "sit-up" batteries or "sinkboxes" were subsequently developed) was uncomfortable. "No favor being accorded to the cramped-up sportsman," reported *Frank Leslie's Illustrated Newspaper* in 1878, although occasionally gunners tossed hay in the coffin box for a meager cushion or placed a piece of heated soapstone between the feet.

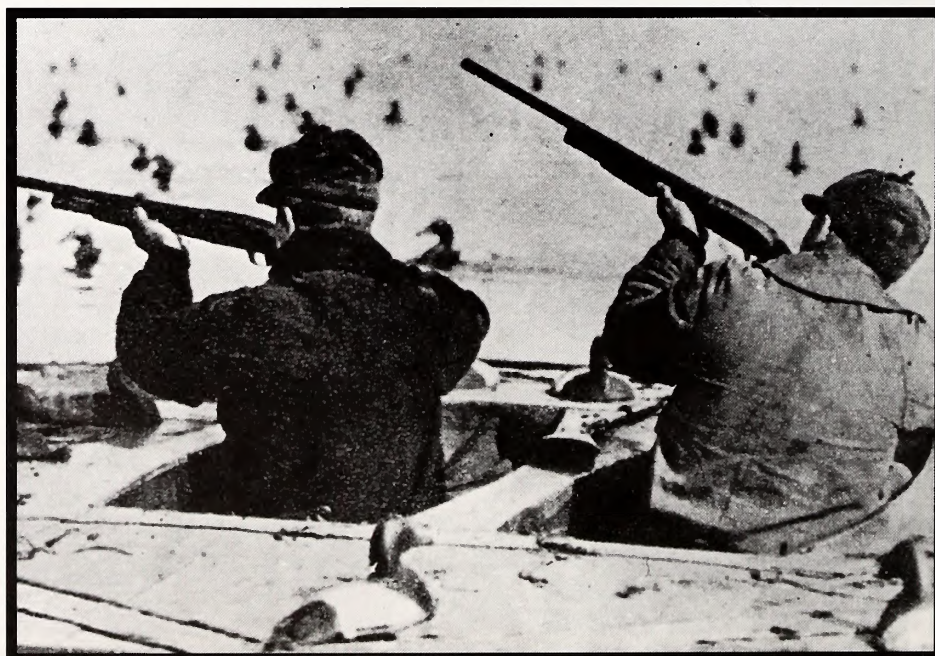
Shooting from a battery was "an ordeal that must have been passed through to be justly appreciated. To lie as though in one's coffin, without moving a muscle,

with the eye and ear ever on the strain, to enjoy the luxury of cramps and stiffness and soreness, while a curting breeze passes over the 'sneakbox,' shaving the face as if by machinery, is the inner life of battery shooting" When storms blew, wrote one waterfowling historian, the hole of a battery "was the coldest and wettest spot in the world."

Floating far out in the middle of the sound, battery gunners slaughtered the ducks. "On Currituck," wrote H.H. Brimley of the North Carolina Museum of Natural Sciences, "bags of a hundred a day from a battery were not rare enough to get one's name in the paper." One day in 1917, Van Griggs, considered a crack shot even by Currituck standards, killed 518 ducks out of his first 600 shots. His pick-up man insisted that his one-day kill must have exceeded 700 birds. On another day, one of Griggs' gunning partners killed 568 ducks, mostly ruddy ducks, out of two 300-shell cases.

Battery blinds were so effective that they eventually became illegal. "If you ever sat in one, in a battery, you'd understand right quick why they outlawed

Wintering ducks,
geese and swans piled
into the shallow waters —
black ducks, pintails,
widgeon and teal packing
into open marsh ponds,
while diving ducks such
as canvasbacks, redheads
and scaup rafted up by
the thousands on the wind-
swept open waters. Stories of
duck flocks that darkened the
sky are not uncommon,
nor far off the mark.



In this photo from the market-hunting era, men shoot from a double sit-down battery.

Courtesy of the Harry Walsh Collection, Chesapeake Bay Maritime Museum



The Whalehead Club in Corolla features hunting displays.

them," Wilson Snowden says. A businessman and lifelong resident of Currituck County, Snowden helped raise and restore the battery blind owned by the Currituck Wildlife Guild, the only one he knows of in the county. "You'd set there, and the ducks come floatin' in right in front of you, just like you walked out there in neck-deep water."

But putting ducks on the water was only a part of the market gunner's task. Getting them to market was the other.

Steamboats such as the *Cygnets*, *Comet* and *Currituck* generally ran three times a week along a route from Norfolk to central Currituck Sound, stopping at Munden Point on Knotts Island, Waterlily on Church Island, Aydlott and on to the Poplar Branch landing. Early on, Poplar Branch evolved as a major commercial hub of the Currituck Sound region, with grocery stores, dry-goods merchants, barbershop, locksmith, gun shop and at least one hotel.

Saunders remembers it well. There was a gristmill near the landing, a store and barrel factory on the end of the dock on the left-hand side and a long, wooden wharf where the steamers tied up, with skiffs and shad boats bobbing on both sides. Down the middle of the wharf ran a track of 4-by-4 planking on which a railroad truck about 10 feet long was mounted for help in loading and unloading freight. Near the far end of the track, out over the water, was the fish and fowl house where ducks were stored and packed for shipping.

"When the season opened," Saunders recalls, "and they went to shooting, Mister John Luke Gregory had a place they called the cooler that was always full of ice where they would hang the fowl up. I've been in it many times, just a rough building, boards up and down with battens on the cracks, and inside where the framing was, it was drove full of nails. The whole place would be lined with ducks, all the way around it as high as a man could reach. I'm satisfied in my mind that there would be from 300 to 400 in there sometimes."

Descriptions of the packing process vary slightly but follow a general pattern:

Birds were shipped unplucked and with all entrails intact. (Game birds can typically be stored in such fashion for a week or more, depending on the weather.) The fowl were packed in wooden fish barrels large enough to hold 150 pounds of perch, black bass, carp or eels. Often a stovepipe was first inserted into the middle of the barrel and filled with ice, and birds were packed around it. As the ice melted, the water drained out of the stovepipe and more could be added. Sometimes a chunk of ice was simply laid into the center of the barrel and birds packed tightly around it, with heads folded under the wings.

Prices paid for waterfowl varied through the years. *Frank Leslie's Illustrated Newspaper* reported in 1878 that canvasbacks brought \$1.10 per pair "on the waters to dealers." Brimley visited "Uncle Ned" Midyette's lodge on Church Island in 1884 and noted that gunners were paid cash on the spot by game buyers: \$1 per pair of canvasbacks, 50 cents per pair of redheads, 30 cents per pair of "common ducks" and 25 cents for a foursome of teal, bufflehead or ruddy ducks, also called boobies.

Continued

Gone are many of the old landings and wharves where generations of Currituckians labored, shipping out fish and fowl and farm harvests. In Poplar Branch, the rotted and ramshackle wharves were burned April 23, 1969, by the Lower Currituck Fire Department at the request of the N.C. Wildlife Resources Commission. A public boat ramp was installed as locals lamented the loss of another piece of the past.

Around the turn of the century, according to Elizabeth City native Jack Baum, the price for canvasbacks varied from \$2 to \$5 a pair, but it seldom dropped below \$2.50; redheads brought about \$1.50; scaup about 75 cents; ruddies from 50 to 75 cents; marsh ducks and swan, 75 cents; and geese from \$1 to \$1.50. "A man had to work hard to make a living at these prices, but some of them did it," Baum says.

As the market matured, with greater numbers of birds and more reliable transportation, hunters sold their birds on commission. In her elegiac memoirs, Edith Gallop Parker recalled that her father had brass stencils from the "commissionmen" he most frequently sold to. "It just took some lamp black mixed with kerosene and a stubby brush to stencil on who it was consigned to and who it was from," she wrote. "Most of the game was shipped to Northern cities to commissionmen who put them on the market and sold them on a percentage basis. And Pa would get a check in return ... All produce was shipped this way, as well as game." Fowl buyers also would visit the batteries out in the sound and purchase ducks directly from hunters.

For the hunters, gunning for market was a reliable source of income at a time of year when there was little money to be made. "The returns in game killed and secured ... are as sure as the profits of any ordinary labor of agriculture or trade, and far larger for the capital and labor employed," observed Ruffin.

During the winter of 1907-1908, the Audubon Society of North Carolina reported that 400 men, "a conservative estimate," shot ducks and geese in Currituck Sound for the market trade. From 1903 to 1909, by another estimate, Currituck market hunters were paid no less than \$100,000 per year for fowl shipped to Northern markets. In the winter season of 1910-1911, according to one report, just under a quarter of a million wildfowl were shipped from Currituck Sound.

Such harvest drew the ire of a nation in the midst of birthing a new conservation ethic. Across the country, the trade in bird skins and feathers for the millinery trade had raised a legion of politically active naturalists with a potent name: the National Association of Audubon Societies. As early as 1885, the trade in wild birds for food had been a cause for concern among the scientific community. By the turn of the century the American taste for wild game had whittled the billion-bird flocks of passenger pigeons down to pitiful remnants — the last sighting in North Carolina came in 1894.

Scorn for market hunters, and in particular the gunners of Currituck, bubbled over at all levels. Few railed with the thunder of William T. Hornaday, the obstreperous director of the New York Zoological Park. Currituck County, he wrote in 1913, is "the bloodiest slaughterpen for waterfowl that exists anywhere on the Atlantic Coast." A poster outlining the migration routes of ducks from across North America to their Currituck wintering grounds was distributed to garner support for protective measures.

Increasingly, the market hunter became a paradox of his time, the provider of a much-sought commodity to a public that could no longer accept the facts that lay beyond the rim of the dinner plate. Measure by measure, a wall of regulation was built around his trade. In 1900, the federal Lacey Act went into effect, establishing the framework for states to use protections afforded interstate commerce by the U.S. Constitution to enforce state wildlife laws. Between 1901 and 1902, portions of the American Ornithologists' Union's "model law" were passed by legislatures in most Atlantic seaboard states.

On March 6, 1903, the Audubon Act became law in North Carolina, making it unlawful to kill any wild bird other than a game bird (liberally defined to include even plover, robin and meadowlark) and various nuisance birds. The Audubon Society of North Carolina was given authority to sell out-of-state hunting

licenses in order to pay for its own "bird and game wardens" to act on behalf of the state. It was, according to the society's T. Gilbert Pearson, "the first law ever enacted in any South Atlantic or Gulf state to provide for a state game-warden system."

The North Carolina organization threw itself into its new duties. In its first year, the Audubon Society of North Carolina fielded 29 wardens, with four stationed in Currituck County to help stem the growing practice of shooting ducks at night with the use of a bright light. By 1907, the Audubon payroll included 100 wardens from the mountains to the coast, and the society's new gasoline-powered patrol boat, the *Dovekie*, was launched in Currituck Sound. Its home mooring was just off the Poplar Branch waterfront.

Then, in 1909, North Carolina passed legislation that broke the back of the Audubon Society's protection efforts. Fifty-two counties, including Currituck, exempted themselves from the Audubon Law and gave local county commissioners enforcement power. The state's short-lived experiment in allowing a private concern to police its marshes, waters and forests was over, but not the movement that gave it life.

In New York in 1911, the Baynes Act was passed, banning the sale of native wild game throughout the state. As the gavel sounded in Albany, 191,376 wild birds, including 98,156 ducks and 48,780 plovers, lay in cold storage in New York City. The East Coast's largest game markets were shut down.

In March 1913, the Weeks-McLean Law took effect, placing waterfowl, migratory game and migratory insectivorous birds under the custody and protection of the federal government. For the first time a federal agency, the U.S. Department of Agriculture, was given the authority to write and enforce regulations to protect wild animal populations. In 1916, federal law prohibited the shooting of wild birds in the spring and banned all night shooting. The United States began negotiating with England on items that had already been agreed upon with Canada, penning the



Wilson Snowden heads out to set decoys on Currituck Sound.

Wilson and Barbara Snowden are keepers of Currituck history. She is a school teacher and Currituck County historian, and he is a businessman, farmer, longtime volunteer fire department chief and boat restorer. Wilson Snowden helped raise and restore the battery blind owned by the Currituck Wildlife Guild, the only one he knows of in the county.

International Migratory Game Bird Treaty. In 1918, Congress voted its provisions into law.

The nation's remaining game markets pulled all birds from their public stalls. The era of market hunting for waterfowl was over for all but poachers and unscrupulous dealers. Any ducks sold in the United States had to be raised on waterfowl farms and harvested by means other than shooting, under permit from the U.S. Department of Agriculture.

Late one afternoon, the day after I meet Saunders in Chesapeake, I drive through the village of Currituck on the western shore of the sound, past the Knotts Island ferry, crowded with school buses, and park in front of the tiny brick Currituck County jail, built around 1820. Across the street, warm golden light streams through the windows of the W.H. Snowden store.

Wilson Snowden closed the store in 1986, 97 years after it opened in the vibrant county seat. The original beadboard counters remain, as do ornately bracketed

wooden shelves, now chockablock with old wooden decoys, miscellaneous tools and a few dusty store ledgers that date back to the first years of the century.

Wilson and Barbara Snowden are keepers of Currituck history. She is a schoolteacher and Currituck County historian, and he is a businessman, farmer, longtime volunteer fire department chief and boat restorer. As twilight fades, we ferret through the store's ledgers, searching for references to the old market hunting trade. We find notations of shot and powder bought and sold, but nothing that we can point to as tactile evidence of Currituck's defining era. In a back room, Barbara Snowden shows me a large black stain on a wall, where for decades you could see where some old storekeeper had written the price paid for ducks and geese. A few years ago, a can of grapefruit juice leaked over the figures, obscuring the numbers. Barbara Snowden's heart sank.

Not much remains of those days. Saunders still has his daddy's 12-gauge shotgun and his granddaddy's old 10-gauge gun, with its Damascus steel barrels. The hand-cut checkering on the stock is nearly

worn smooth. There are a few old battery weights and iron decoys around, but of all the gunning batteries used in Currituck Sound, only a few are known to exist. "They just let 'em go to pieces," Wilson Snowden explains, "somewhere out there in the marsh, like you would an old boat."

Gone, too, are many of the old landings and wharves where generations of Currituckians labored, shipping out fish and fowl and farm harvests. In Poplar Branch, the rotted and ramshackle wharves were burned April 23, 1969, by the Lower Currituck Fire Department at the request of the N.C. Wildlife Resources Commission. A public boat ramp was installed as locals lamented the loss of another piece of the past. "This is the date of the end of the 'Good Old Days in Currituck County,'" resident Seward Parker wrote to a local newspaper.

Now it takes great effort to uncover even the tiniest remnant of Currituck's market hunting era. "People just can't imagine how it was back in those days," Saunders says, and for the briefest moment he holds his hands very still. "The average person just don't know." ■

Blackbeard's Flagship?

SEARCHING A SHIPWRECK FOR CLUES

By Julie Ann Powers

Whether a submerged shipwreck near Beaufort Inlet was once a vessel commanded by the infamous pirate Blackbeard is still a secret known only to the sea.

But a convincing picture of an 18th-century pirate ship has emerged with the gold dust, broken bottles and cannons brought up from the shell-encrusted mound.

And tantalizing historical parallels prompt officials to stop just short of saying for certain the *Queen Anne's Revenge* has been found. The flagship of Blackbeard's fearsome fleet was last seen sinking in the inlet after running aground in June 1718.

Jeffrey Crow, N.C. Division of Archives and History director, says divers have yet to find definitive evidence — “a smoking blunderbuss” — to prove the ship's identity.

“But we have found plenty of shot to load that blunderbuss,” he says.

Lead shot is among hundreds of artifacts brought up in 500 hours of diving last fall. It was the second major effort to map the site and recover items since the wreck was discovered Nov. 21, 1996, in about 20 feet of water.

A few gold flecks, pewter dishes, a syringe, navigational instruments, onion-shaped wine bottles, a clay pipe and barrel hoops are also products of the latest dive. A bronze bell, a brass blunderbuss barrel, cannons and cannon balls, a sounding weight, broken bottles and ballast stones were brought up in previous dives.

Researchers still hope to find indisputable proof the ship is what they think it is — ideally something engraved *Queen*

where the ship put into port. According to a recently rediscovered description of *Concorde's* capture, its officers were robbed of gold dust when Blackbeard's band seized the Caribbean-bound slave vessel in 1717. *Concorde* was overtaken off the coast of St. Vincent in the eastern Caribbean, as it traveled between Senegal and Martinique.

“We haven't found Blackbeard's treasure by any means,” Crow says of the shiny bits. “But it is an important clue to what may have been on this particular ship.”



CREWMATES WRESTLE WITH A CANNON RETRIEVED FROM THE WRECK.

Jim Bounds, courtesy of The News & Observer

Anne's Revenge or *Concorde* — the ship's name before Blackbeard captured it. Or maybe Edward Teach or Thatch, the bewhiskered pirate's aliases. Lacking that, they are analyzing each artifact for dates or characteristics that might tell about the ship that carried them nearly three centuries ago.

The gold dust — weighing less than two paper clips — is a valuable find, though it's unlikely to signal a treasure trove awaits underwater. Blackbeard probably loaded his loot onto his other vessels before *Queen Anne's Revenge* succumbed to the waves.

If chemical analysis reveals where the gold originated, however, it might also tell

Blackbeard had been a privateer preying on French ships during Queen Anne's War before going into pirating for himself. He renamed his prize *Queen Anne's Revenge*.

The flagship was among four ships in Blackbeard's force, which at times included 300 or more men. The ruthless brigands attacked mariners from New England to the Caribbean. Blackbeard was killed in a gory battle at Ocracoke a few months after the grounding.

The ballast stones from the wreck, used to keep the ship upright, are less scintillating than gold dust but could prove as important.

The rocks are a volcanic variety found in the Caribbean and in France. A Caribbean identity wouldn't add anything conclusive to the story. But if analysis shows minerals unique to Nantes, France, where the *Concorde* first floated, the ballast could point to Blackbeard.

"If we do identify them as being French in origin, that would be an important clue as well," says Crow.

While awaiting results of such studies and combing archives for more overlooked

we'd expect to find *Queen Anne's Revenge*," Crow says.

A pewter syringe brought up last fall could be the renowned pirate's mark. Blackbeard had blockaded Charleston's port for a week before heading up the coast toward Beaufort.

"One of the things he was trying to secure was medical supplies for his crew," Crow says. Some accounts say syphilis was widespread among the men.

A pair of chart dividers, also brought

steadily, as one aground would do, rather than tearing apart in a storm. The smallest of three anchors, set 400 feet south of the site, suggests the long-ago sailors tried to kedge off the sandbar.

The anchors are large enough to eliminate the possibility that the wreck is *Adventure*, Blackbeard's smaller sloop that sank at the same time, possibly while assisting *Queen Anne's Revenge*. *Adventure* has not been found.

Hurricane Bonnie in August 1998 reburied some of the wreck, but it also exposed a 27-by-8-foot section of hull. The timber is perfectly preserved by decades in the sand.

"You can see the grain work. You can see the little wooden pegs," says Mark Wilde-Ramsey of the N.C. Underwater Archeology Unit, who led the 1998 dive project.

The wood could fill in several blanks in the shipwreck's story. It will be analyzed and carbon-dated, and the hull shape will be studied for signs the holds were designed for human cargo. The 90-foot *Concorde* was built of white oak in about 1713 as a slave ship, records say. The three-masted ship had a carrying capacity of 200 tons, a 25-foot beam and a draft of 12 1/2 feet. As *Queen Anne's Revenge*, it accommodated 125 to 150 pirates.

Divers have counted 18 cannons so far in the jumbled mass. Their number and varying size are strong testimony the wreck was Blackbeard's flagship. *Queen Anne's Revenge* was armed with 40 of the big cast-iron guns. Three have been brought up for conservation.

"It almost seems like anywhere you go out there and dig, you find cannons," says Richard Lawrence, head of the underwater archeology unit. Merchant ships of the period probably carried fewer, smaller cannons, experts say, and a naval vessel's firepower would have been more uniform in size.

Smaller armament also points to pirates. Lead shot, found in large quantities, ranges in caliber from the size of a BB to the diameter of a dime.

"These could be used in pistols,



TRANSFER OF THE CANNON REQUIRES PATIENCE AND PRECISION.

Jim Bounds, courtesy of The News & Observer

records, experts contend everything they know so far supports the theory the wreck is what's left of *Queen Anne's Revenge*. And nothing contradicts it. All items identified so far predate the 1718 sinking.

The bronze bell, one of the first items brought to the surface, is inscribed with the date 1709, and the name *IHS Maria*. Historians theorize the foot-tall bell was taken from a captured vessel or a plundered port town. Pewter dishes made by London pewterer George Hammond date to the early 1700s. Two onion-shaped English wine bottles are circa 1714.

"That puts us precisely in the period

up in 1998, is identical to the navigational tool in use today. Others instruments recovered are not so recognizable.

"We aren't altogether sure what they are," Crow says. "Some probably have to do with navigation." Many items might have been common aboard any ship of the times, Crow cautions.

"We can't say that these were Blackbeard's," Crow says. "But they give us important evidence we hope to develop further."

Historians also are studying what is left underwater and its positioning. The compact debris field indicates the ship sank

Continued

muskets, blunderbusses or even put into bags and fired out of a cannon," Lawrence says. The latter is described as the 18th-century version of the Molotov cocktail.

"Pirates were interested in antipersonnel-type weaponry," he says. "They wanted to cause the crew to surrender with as little damage as possible."

The closely guarded site is about a mile from Fort Macon's shoreline and 1,200 yards from what is now the inlet's main channel. Geologists say strong currents and shifting sand have covered and uncovered the upper portion of the wreck many times over the centuries.

Intersal Inc., a Boca Raton, Fla., treasure-hunting company, found the wreck. The Tar Heel coastline is known to have claimed hundreds of ships, and Intersal initially was hunting a gold-laden Spanish packet that sank in 1750.

The company began looking for *Queen Anne's Revenge* in 1988, after reportedly uncovering an eyewitness account of the sinking in a London archive.

North Carolina law dictates that the wreck belongs to the state. Intersal has formed a nonprofit arm to work with North Carolina. Mike Daniel, who found the wreck and now heads the nonprofit group, says the partnership is unusual in the treasure-hunting industry, but Intersal wants the artifacts kept together. Objects from most famous shipwrecks have been split up and sold, he says.

"This is probably the most important shipwreck in the world, in my opinion, because of the history that surrounds it," he says. Intersal hopes to recoup \$300,000 in expenses by selling the story of the find and possibly artifact reproductions.

When the discovery was announced in 1997, coastal communities such as Bath, Hatteras village, Beaufort and Ocracoke began feuding over which should get the shipwreck goods as a tourist draw.

State officials say the N.C. Maritime Museum in Beaufort is the most likely repository, but it will be years before any major display is ready. In the meantime, the bell, the blunderbuss barrel and other cleaned artifacts periodically circulate the state in a traveling exhibit.



HISTORIANS AND CONSERVATIONISTS WORK TO CLASSIFY AND CLEAN THE WRECK'S BOUNTY.

Jim Bounds, courtesy of The News & Observer



THE CLEANED ARTIFACTS CIRCULATE THROUGHOUT NORTH CAROLINA, MUCH TO THE DELIGHT OF PIRATE FANCIERS.

Candice Cusic, courtesy of The News & Observer

The majority of the 350 items brought to the surface are under conservation at the underwater archeology lab in Kure Beach and the new Gallants Channel lab in Beaufort, which was remodeled from an abandoned scallop house on property acquired by the Friends of the N.C. Maritime Museum in 1996.

Bringing up the entire wreck, as researchers dream of doing, will cost millions and take at least five years; conservation even longer. If, that is, facilities and funds materialize.

Museum supporters want to build a 16,000-square-foot conservation lab in Beaufort, described by the Friends president as a "top-grade" operation.

"We're talking about a multimillion-dollar facility," says Grayden Paul Jr.

The 1997 and 1998 dives were paid for with \$450,000 in state money and \$50,000 in local funds. Officials say the cost of in-kind contributions — state facilities, expertise, vessels and equipment — is impossible to calculate.

The next dive is tentatively scheduled for fall, when water conditions are optimal. Even if the shipwreck turns out to be a vessel less renowned than *Queen Anne's Revenge*, historians say the find nevertheless adds new chapters to nautical knowledge.

The worldwide attention to the wreck causes some consternation about the

glorification of pirates, who were akin to modern-day hijackers and terrorists.

"They certainly weren't admirable people," says Betty Ray McCain, secretary of the North Carolina Department of Cultural Resources.

But, she says, elementary school teachers assuage her concerns.

"They tell me, 'We've tried everything on the face of the Earth to get kids interested in history,'" she says. "'And you've finally done it.'" □

The shipwreck has a state-maintained Web site: <http://web.dcr.state.nc.us/blackbeard.htm>.

BLACKBEARD: THE MAN AND THE MYTH

By Julie Ann Powers

Despite a fierce reputation that has survived nearly three centuries, Blackbeard wouldn't be called a successful pirate. Those were rich men who died a quiet death at an old age.

But Blackbeard certainly was notorious.

He was born Edward Drummond around 1680 in Bristol, England, according to history books. He assumed the surname Teach, also spelled Thatch, Tache or Tatch, as a pirate. His more well-known nickname came from his dark, bushy whiskers.

Legend says that Blackbeard, a big man with a formidable countenance, used his beard to heighten any pirate's biggest weapon — the ability to engender fear. Before battle, he supposedly braided his whiskers into pigtails and tucked slow-burning matches amongst them or behind his ears, sending curls of smoke around his face.

Blackbeard was always armed with an array of daggers, swords and

loaded pistols, though some historians say there's no evidence he killed anyone until the day of his own death.

His nautical bad-guy career began during Queen Anne's War, as a privateer sailing out of Jamaica to attack French merchant ships.

After the war ended in 1713, Blackbeard crewed for another pirate in the Bahamas. He captured the French slaver, *Concorde*, in 1717. When he was rewarded with its command, he renamed it *Queen Anne's Revenge*.

At its largest, his force included four ships and 300 or more men. The fleet assaulted mariners from the Caribbean to New England. North Carolina's coast offered several hideouts from colonial and British authorities. An anchorage at Ocracoke is still called Teach's Hole. Bath was another Blackbeard haunt.

North Carolina's Gov. Charles Eden reportedly shrugged at pirate activity and possibly shared in Blackbeard's booty. Eden pardoned the pirate in June 1718.

Blackbeard supposedly was semi-retired in November 1718 when he met his end at Ocracoke. In fact, some historians

theorize the losses of *Queen Anne's Revenge* and a smaller sloop, *Adventure*, in June 1718, were intentional. Grounding the vessels in Beaufort Inlet might have been the pirate's way of "downsizing" his business.

Pirate attacks off the colonial coast continued, however, and Virginia's Gov. Alexander Spotswood blamed Blackbeard. Not so forgiving as Eden, he put a price on Blackbeard's head and urged the British military, the Virginia Assembly and Eden's opponents to help capture him.

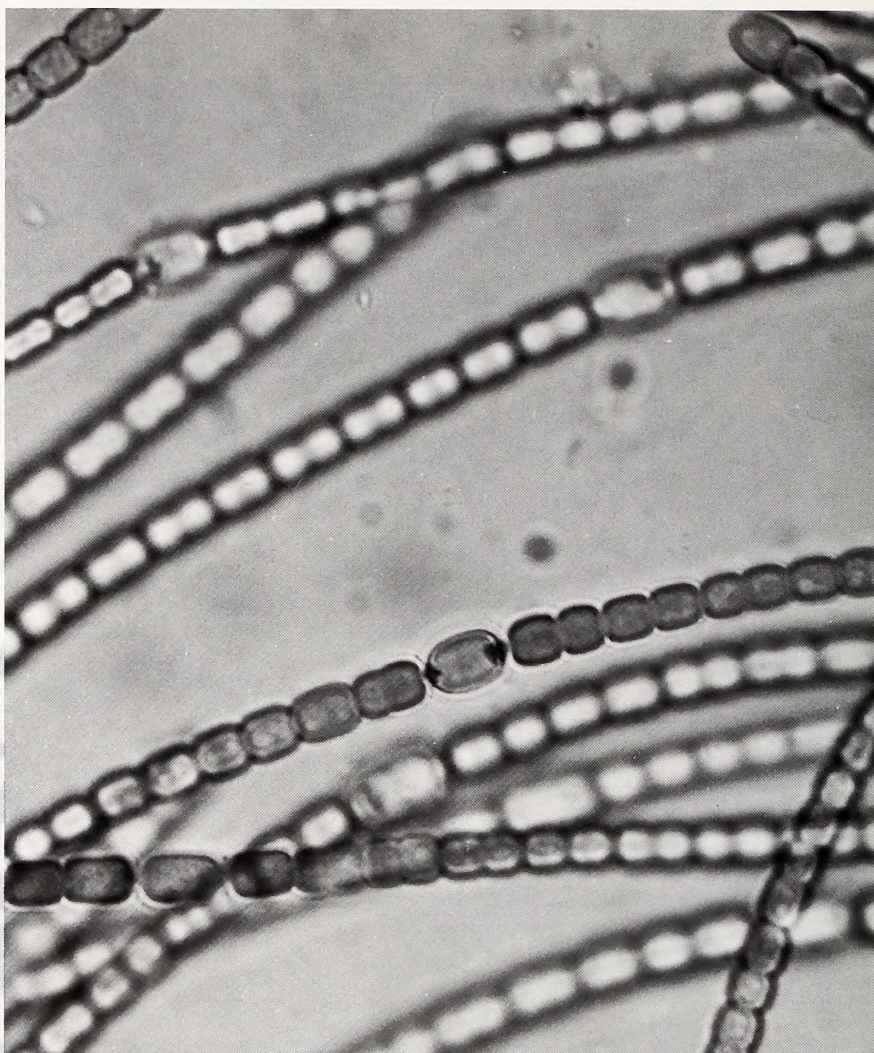
Blackbeard was tricked into battle by Lt. Robert Maynard off Ocracoke Nov. 22, 1718, on a British sloop. According to legend, the pirate fought on even after being shot, stabbed and slashed across the throat, until he died while cocking a pistol.

It was the custom of the times to display dead pirates as a deterrent to the occupation. Blackbeard's severed head was hung from the bowsprit of Maynard's ship. □

Patience Pays Off:

The Rebirth of the Chowan River Gives Hope for the Neuse

By Barbara A. Doll and
Renée Wolcott Shannon



Hans Paerl

*Anabaena, a microscopic blue-green algae
of the kind that plagued the Chowan River*

These days, the Neuse River dominates media coverage of water quality issues. Headlines scream about *Pfiesteria piscicida*, excessive nutrients and fish kills. Mention of the Chowan River is pretty infrequent, even among water quality professionals. But the Chowan River is where North Carolina began its fight against excess nutrient pollution.

The Chowan River begins in southeastern Virginia at the confluence of the Nottaway and Blackwater rivers. Three-quarters of its 4,890-square-mile drainage area lie in Virginia. The river flows southeast to Edenton, where it pours more than 1 trillion gallons of fresh water into Albemarle Sound every year.

But in the 1970s, severe algal blooms,

fish kills and fish disease in the Chowan River catalyzed local volunteer efforts and landmark research and regulatory action in North Carolina. The state passed its first laws for controlling the discharge of nutrients in an attempt to curtail the environmental damage. In May 1979, the Environmental Management Commission established the Nutrient Sensitive Water (NSW) supplemental-use classification to place nutrient limits on wastewater plant discharges to rivers. The Chowan River was the first river to receive this supplemental classification.

Nutrients are essential to river and coastal estuarine ecosystems; they feed the growth of phytoplankton, forming the base of the food chain. But in excess they can



The Arrowhead Club boat ramp shows the beauty of the Chowan River today.

cause unmanageable growth of algae and other aquatic plants that rob the water of oxygen. The lack of oxygen may lead to fish kills, and fish disease often increases as a result of environmental stress.

Though runoff contributes more than 70 percent of the nutrients polluting the water in both the Neuse and Chowan river basins, the rivers' watersheds are very different in terms of land use and development. The Neuse River basin contains one of the state's largest metropolitan areas and experiences high population growth. By contrast, the Chowan River basin contains small towns like Murfreesboro, Ahoskie and Rich Square. Overall growth declined by 1 percent in the North Carolina portion of the river basin between 1970 and 1990.

A Dying River

The problem with nutrients in the Chowan surfaced in the early 1970s. The most severe blooms of blue-green algae were reported in the lower portions of the river in 1972 and 1978, when warm, dry summers followed high spring flows. Fish kills and a high incidence of red sore disease in fish also indicated water quality problems in the river.

The 1972 bloom concentrated near Colerain and lasted from June to August. Conditions were so severe that one newspaper described the bloom as "gangrenous velvet blanketing the river." By October, the *Winston-Salem Journal* declared the river dead.

Fishers and riverside residents were

especially outraged at the situation. Shoreline residents complained that the rotting algae smelled bad and that their bathing suits were stained green. Volunteer groups formed to raise awareness of the problem and to search for solutions.

By the late 1970s, the massive growths had expanded to cover more than a 20-mile stretch of the river, from Holiday Island to below Edenton. Town officials complained in 1978 that the water turned green in July and remained that way until December, putting a damper on tourism. During several summer kills, it seemed possible to walk across the dead bass and catfish on the surface of the river.

Fishers feared for their livelihood,

Continued

complaining that catches had declined and that red sore disease was on the rise. Many claimed that they had not seen red sores on fish until the early 1970s, when the algal blooms began. Surveys revealed red sore outbreaks from the Chowan River to the Scuppernong River, with the highest incidence in the Chowan.

In 1976, an outbreak of the disease killed about 95 percent of the Albemarle Sound's white perch population. Researchers determined that the sores were caused by *Aeromonas hydrophila*, a bacteria that flourishes in polluted water. They suspected that environmental stress from the declining water quality in the Chowan River was contributing to the outbreaks. The only way to fight the disease was to improve water quality.

A fertilizer plant near Tunis was implicated as a primary source of nutrients contributing to the algal bloom problem in the Chowan River. As many as 4,000 pounds of nitrogen were being discharged from the plant into the river each day.

Research also strongly implicated farming practices and changes in drainage and forest cover as contributors to the problem. Researchers from the University of North Carolina at Chapel Hill noted that though there had been a decrease in farmland in the river basin since 1950, the yields for all major crops had risen due to mechanization and increased fertilizer usage. This study also documented that 67 percent of the North Carolina farmland in the Chowan River had been ditched for drainage to the river, compared to only 6 percent of Virginia farmland. In addition, there was a 30 percent decrease in wetlands forested with oak, gum and cypress in the North Carolina portion of the basin between 1964 and 1974.

These changes in land use are significant to nutrient loading. Increased fertilizer use creates a greater potential for excess nutrient runoff. Ditching and draining of cropland decreases the travel time of water moving from a field to a nearby creek or stream, thus reducing the time for microbes in the soil to break down excess nutrients. Research has shown that swamp forests in



Scott D. Taylor

Alfred Howard and the Arrowhead Property Owners Association still monitor the river every week.

the Chowan River basin can remove 83 percent of the nitrogen and 51 percent of the phosphorus from streams that pass through them. The loss of these habitats means greater release of nutrients into waterways.

The Chowan, Pasquotank and Roanoke are the primary rivers that feed the Albemarle Sound. The Albemarle is considered a lagoonal estuary because it is very shallow and has a slow flushing rate since the Outer Banks restrict the water's exchange with the ocean. The Albemarle Sound is only about 20 feet deep at its center. As a result, the lower portions of the rivers and the sound they drain into have a relatively small volume and are sensitive to nutrient loading.

Dedicated Volunteers

When retired Navy Capt. Alfred Howard moved to Edenton in 1974, he quickly realized that something was wrong with the river. He had fallen in love with the Chowan in 1967, while on leave from his ship in Norfolk, Va. On a drive along the coast, he stopped in Edenton, saw that there were lots for sale along the river and bought one the same afternoon. Now, after buying two more lots, he has 165 feet of waterfront property.

But in 1974 and 1975, the river was in "pretty bad shape," Howard says. "It stunk like an open sore." When the algal blooms were thriving, the surface of the water was a thick green sludge that rarely cleared. "There were days when the wind blew in the right direction and blew it to the other

side of the river," Howard says, and then people would go in swimming. "At the blue stage, it would stain swimsuits. It left green and blue collars on the piers and pound net stakes, and a blue smear along the beach where it met the water."

Homeowners in the Arrowhead community, where Howard lives, were furious. "Everybody was upset, and somebody had to take the lead," Howard says. So he did.

With a group of friends from the Arrowhead Property Owners Association, Howard signed on with the regional Stream Watch program. Now incorporated into the N.C. Department of Environment and Natural Resources (DENR), Stream Watch helps local residents to "adopt" a waterway and act on its behalf. The new volunteers gathered information about the water

quality, ecology and history of the Chowan, and they searched for industries and other facilities contributing to the pollution of the river. With the help of a fisheries grant from the Z. Smith Reynolds Foundation, the Arrowhead group also purchased a water-quality test kit and began monitoring the river's dissolved oxygen levels, pH, turbidity, salinity and temperature.

Armed with new information, the volunteers began publicizing the river's plight and encouraging other residents to get involved. Residents from the Arrowhead community traveled up and down the river, getting the word out to as many people as they could. "We attended women's clubs and Lions clubs, letting them know what was going on and how to help," Howard says.

Group members also attended public hearings for National Pollutant Discharge Elimination System (NPDES) permits, which industries and treatment plants must maintain in order to discharge wastewater. If the Arrowhead group believed that businesses were not abiding by the regulations required to maintain the permit, they spoke up about it at the hearings.

Patrick Stanforth, director of the Albemarle-Pamlico Citizens Water Quality Monitoring Program between 1997 and 1998, has high praise for Howard. When the monitoring program was established in the late 1980s, Howard's group immediately joined. "He's as grassroots as they get," Stanforth says. "He's one of the cornerstones of it being a productive program."

The Albemarle-Pamlico Citizens Water Quality Monitoring Program receives funding through the Environmental Protection Agency's Albemarle-Pamlico Estuarine Study (APES). Citizens' groups that work with the program receive water-quality monitoring kits and test the water every Tuesday. The data are checked for accuracy at East Carolina University and then compiled into a baseline data set for the river.

Recently, the program had enough money to purchase a Hatch 2000 monitoring kit, which measures nitrogen and phosphorus levels. It's a more expensive and sophisticated instrument than the usual test kits, and the Arrowhead group was selected to use it. "With Captain Al there, we know the Chowan is in good hands," says Stanforth. "I couldn't pick a better advocate for the river."

A Decade of Research

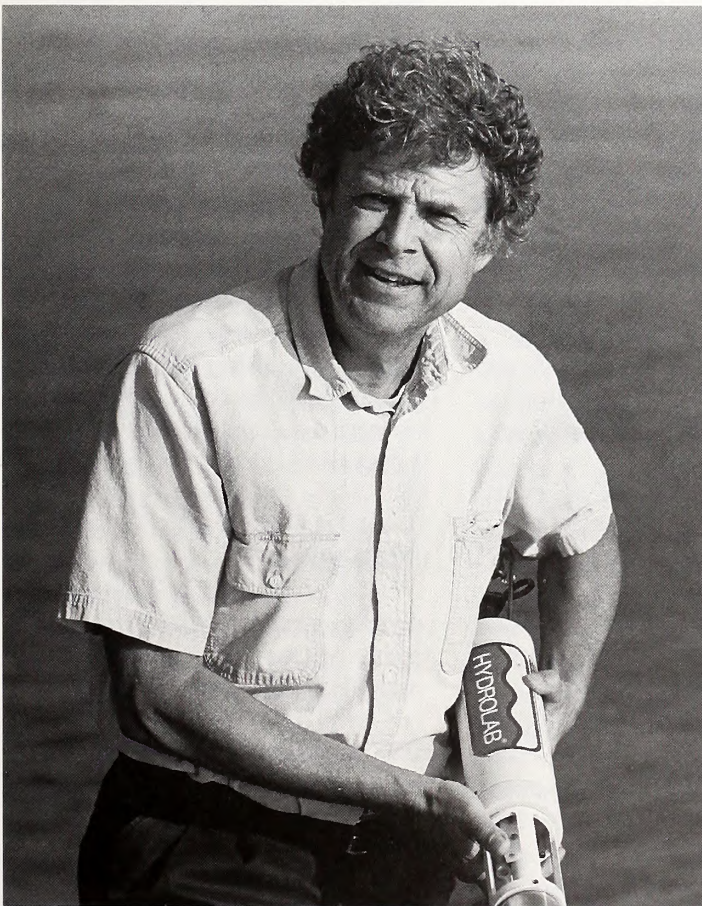
Scientists also rallied to defend the river.

"I think the Chowan has been a real success story," says Hans Paerl, a Sea Grant researcher at the University of North Carolina at Chapel Hill. "We hear horror stories about science being slow to respond to problems — that scientists sit in the ivory tower without solutions to practical problems. But in the 1980s, research supported by Sea Grant and the Water Resources Research Institute provided some timely answers and nutrient-reduction strategies."

In conjunction with the institute, North Carolina Sea Grant focused extensive research efforts on river and estuarine processes. Scientists studied flow dynam-

Continued

Scott D. Taylor



Hans Paerl, a Sea Grant researcher and champion of water quality improvement on the Chowan

ics, nutrient loading and algal response in major coastal river systems. Their research located areas where nutrients were deposited and confirmed that those areas were prone to algal blooms.

Through more than a decade of work, researchers were able to identify limiting nutrients over seasonal, spatial and climate changes, and they characterized the dominant algal communities during various seasons and nutrient loading patterns.

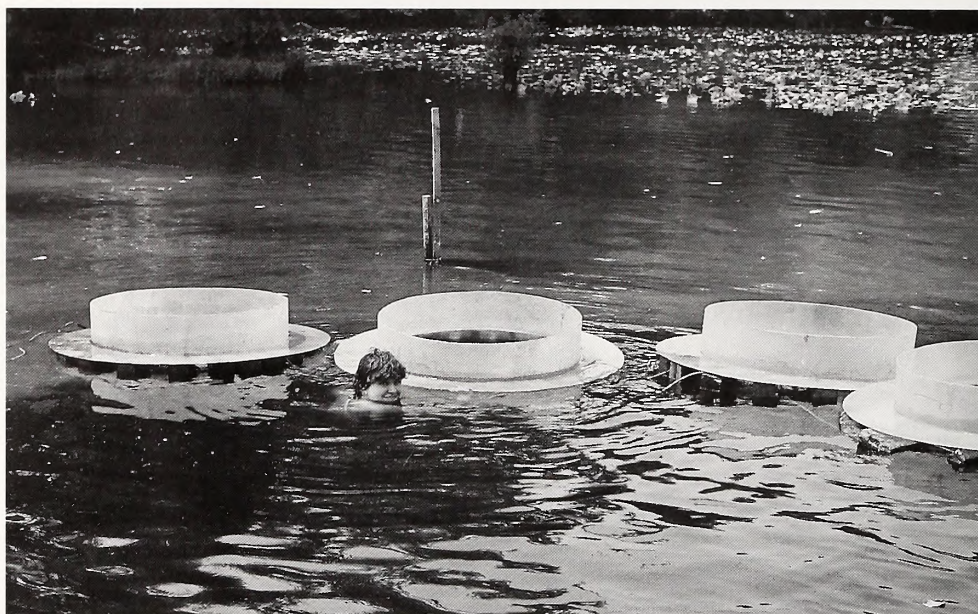
Charles Daniel, a researcher from the U.S. Geological Survey, developed a model to describe the water flow in the Chowan River. Water movement patterns affect algal growth and dispersal.

The model verified that both lunar and wind tides are present in the Chowan, but that the wind tides are far more significant. During low flows, however, lunar tides can influence the river as far north as the Blackwater River, which is six miles north of Franklin, Va.

Augustus Witherspoon, a North Carolina State University researcher, showed that the river could be subdivided into two sections. The upper river had nutrient concentrations great enough to support relatively high algal growth, but the water flow there was too fast to allow for excessive phytoplankton growth.

By contrast, the slow-moving lower river acted more like a lake. This allowed for more interaction between algae and nutrients, resulting in high algal growth. Blue-green algae that formed surface blooms dominated the species composition of the lower river, as is common in nutrient-enriched freshwater areas.

Other work focused solely on nutrients and algal growth. John Hobbie, currently of the Marine Biological Laboratory in Woods Hole, Mass., and Don Stanley, now at East Carolina University, found that high rates of nitrogen loading prompted algal blooms. Nitrogen and phosphorus are the key nutrients that



Hans Paerl

In 1983, researchers used experimental enclosures to examine the effect of nutrient additions in the Chowan.

support algal growth in aquatic systems. Often there is plenty of one nutrient but not enough of the other. The lacking nutrient is considered the limiting nutrient because it controls the productivity that can take place.

In freshwater systems, phosphorus is usually the limiting nutrient. In estuarine systems, on the other hand, nitrogen generally controls algal production. In the lower Chowan, however, Hobbie and Stanley found that nitrogen from decomposing organic matter in the sediments functioned as the limiting nutrient for algal growth mainly during the summer instead of year-round.

Later studies by Ed Kuenzler, a UNC-Chapel Hill researcher, found that both phosphorus and nitrogen simultaneously limited total algal growth in most experiments, but that phosphorus was the most critical limiting nutrient to certain species of blue-green algae that dominated blooms in freshwater segments of the lower Chowan River.

Paerl confirmed these findings and showed that high nitrogen inputs during the spring created a potential for early blooms of species other than blue-green algae. His work also showed that once these blooms died and sank to the bottom of the river, their decomposition depleted oxygen levels.

Phosphorus was then released in this anaerobic (oxygen-free) environment and stimulated blue-green algae blooms later in the summer.

From this decade of research, scientists were able to conclude that controls of both nitrogen and phosphorus were necessary to reduce the frequency and magnitude of algal blooms in the river. Reducing the amount of nutrients flowing into the river would also reduce the concentration of chlorophyll-a, a plant pigment used to measure phytoplankton growth. Witherspoon and Roger Pearce, his graduate student, provided specific guidelines for reducing these nutrients.

Two Decades of Management

The fertilizer plant in Tunis stopped discharging nitrogen into the river in 1972, and the next few years saw a marked reduction in algal blooms. In 1976, however, small pulse blooms appeared, and in 1978, severe blooms recurred. State regulators verified that nutrients continued to seep from storage lagoons at the fertilizer plant.

In addition, the United Piece Dyeworks plant near Colerain and the Union Camp pulp and paper facility in Franklin, Va., were identified as significant point sources of nutrients in the basin. North

Carolina and Virginia cooperated to reduce the pollutant load from Union Camp, and the paper plant began storing its waste for the eight months of the year when river flow is low, discharging only between December and March.

In 1979, implementation of the Nutrient Sensitive Water classification placed nutrient limits on wastewater treatment plants discharging to the river. As a result, major municipalities began spraying their discharges onto land as a form of irrigation. This was the only means of reaching the strict nutrient limits of 3 parts per million (ppm) total nitrogen and 1 ppm phosphorus. With land available and reasonably affordable to most of the major municipalities that bordered the river, this was a feasible solution. Land application of wastewater had previously been tried only in experimental demonstration projects in North Carolina.

Land application of wastewater enables microbial communities in the soil to break down and transform nutrients and other pollutants before they reach the river. It is difficult to quantify the nutrient reduction that resulted from this change, but estimates show that the contribution from municipal sources in the North Carolina portion of the basin are down from about 20 percent of the total load to around 1 percent.

Despite aggressive measures to deal with point source pollution, regulators soon realized that more effort was needed to solve the problem. With forests, wetlands and agriculture comprising the primary land uses in the river basin, and agricultural runoff and animal waste contributing an estimated 80 percent of the total nitrogen and phosphorus flowing to the river, nonpoint sources of pollution had to be reckoned with in order to solve the bloom problem.

In 1982, the N.C. Department of Natural Resources and Community Development (now the N.C. Department of Environment and Natural Resources) developed the Chowan/Albemarle Action Plan and the Chowan River Water Quality Management Plan. The Chowan River plan called for a 30 to 40 percent reduction in

phosphorus and a 15 to 20 percent reduction in nitrogen. The plan included limits on both nonpoint and point sources of pollution.

Agricultural Best Management Practices (BMPs) became an important component of the water quality improvement plans for the Chowan River. Farmers were asked to voluntarily establish BMPs to reduce erosion and nutrient loading from their crops and animal facilities. A three-year study concluded that farmers in the basin needed education and technical assistance because they had not adjusted the application rates of fertilizer to take into account the nutrient-rich animal waste they were also applying to their crops.

In 1985, with funding from the North Carolina legislature, the Agricultural Cost Share Program was implemented in the Chowan River basin. The program was designed to provide technical and financial assistance to farmers who implemented BMPs. The BMPs were intended to reduce erosion, properly manage and improve land application of animal wastes, improve fertilizer application in relation to crop needs to reduce excess nutrient loading, and ensure proper handling and disposal of pesticides and reduce their use.

Farmers began testing their soil, using conservation tillage, splitting applications of fertilizer and establishing grass in waterways and field borders to prevent erosion. In some cases, hogs had to be removed from swamps, but most animal farmers only needed better storage and training in the proper land application of animal waste. Drainage and irrigation systems also were improved throughout the basin to reduce subsurface movement of nitrogen to surface waters.

Over a five-year period, the state made 809 agreements with farmers in the Chowan River basin to address nonpoint source problems on 63,655 acres of land. An estimated 123,244 tons of soil erosion has been prevented annually as a result. Forty-eight million gallons of animal waste have been applied to crops rather than stockpiled in feedlots or overflowing lagoons.

Documenting Success

In 1990, regulators began compiling the figures on the nutrient loads and chlorophyll-a levels in the river since the Chowan River plan was put into effect in 1982. They found substantial reductions in nutrient loads, achieved primarily through eliminating wastewater treatment plant discharges, closing the Tunis fertilizer plant and implementing the agricultural BMPs. Calculations revealed that phosphorus had been reduced by 29 percent and nitrogen by 22 percent.

Consistent monitoring in the river at several stations revealed seasonal fluctuations in levels of phytoplankton growth through the mid-1980s, accompanied by a downward trend in growth from the 1980s to the present. Near Colerain and Edenton, the areas previously most plagued by algal blooms, summer chlorophyll levels remained high until 1991 but have since dropped significantly.

Today, the Chowan River is much healthier than it was in the 1970s. There has been a notable decrease in the duration and frequency of algal blooms. Tourism thrives in Edenton. Though overfishing threatens the river herring industry, striped bass and white perch fisheries have improved steadily since the early 1980s.

Volunteers from the Arrowhead Property Owners Association continue to monitor the water and collect data, but they are much happier with the river's health. "This last summer was beautiful," says Howard. "There was some spotty cover in spring but no penetration into the water column."

Scientists and regulators are also pleased with their progress. "The results speak for themselves," says Paerl, the UNC-CH researcher. The Chowan River is a case where "science translated into management and policy."

With the implementation of the Neuse River Nutrient Reduction Rules in August 1997, the Neuse River should also begin the journey to improved health. The Neuse River basin could take more than 20 years to flush out the nutrients already stored in its soils and sediments, but the Chowan's rebirth teaches patience and hope. Water quality improvement takes time. ■

On the Trail of Giants:

Bluefin Tuna Research Expands to Cape Lookout

By Katie Mosher • Photographs by Scott D. Taylor



Michael Orbach, director of the Duke University Marine Lab, angles for a giant tuna.

Anglers were reeling in bluefin tuna weighing up to 600 pounds off Cape Lookout this winter — but the biggest catch of the season could be the scientific data gathered on more than 100 of these giant fish.

Bluefin have been caught and studied off Cape Hatteras for several years, but for the first time researchers based in Carteret County tagged bluefin

to gather data on migration patterns.

“We are looking at how bluefin tuna in the western Atlantic waters relate to the rest of the bluefin in the Atlantic Ocean,” says Barbara Block of the Tuna Research and Conservation Center on the Monterey Peninsula in California. Block has led the Tag-a-Giant bluefin research project in North Carolina since 1996.

The bluefin are noted not only for

their size but also for their commercial value. The meat can sell for \$30 to \$60 per pound. “Bluefin tuna are the most lucrative fish in the world today. A single fish can sell for over \$50,000,” Block says.

The value of the bluefin goes beyond the commercial dock. The arrival of sportfishers is a great economic boon to coastal communities. These anglers spend money on housing, meals and charter

services, even though they often choose to release the catch live.

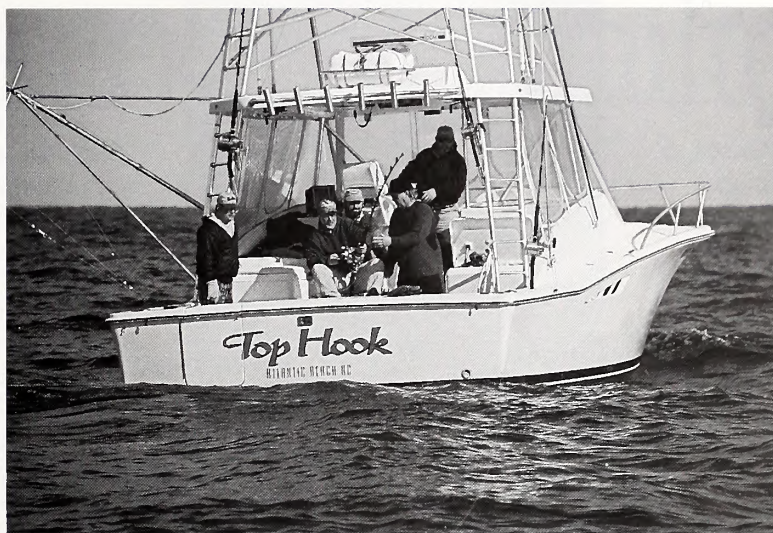
An international organization based in Madrid, Spain, sets landing quotas for bluefin. The United States has seen a declining population of the giant fish, which are extremely popular in Japanese food markets. Some East Coast states have commercial bluefin fisheries, but North Carolina is limited to a recreational fishery, so anglers who decide to keep their bluefin cannot sell it upon their return to the dock.

In early 1998, North Carolina Sea Grant fisheries agent Jim Bahen heard reports of large bluefin near Cape Lookout. Few of the giant fish were caught that season, says Bahen, who has worked with both Block and Eric Prince, a National Marine Fisheries Service researcher. Bahen is on the steering committee for a catch-and-release symposium in December in Virginia Beach.

Bluefin, as well as marlins and swordfish, are considered pelagic fish because they are at home in the open ocean. "They are the top of the food chain," Bahen says.

In North Carolina, he adds, the fish apparently feed on gray trout and croaker as well as the more traditional diet — menhaden.

In late December 1998, the Tag-a-Giant (TAG) program began looking for



In December, boats caught one or two giant tuna per day.



Researchers implant an archival tag in a giant tuna.

large bluefin off Cape Lookout. The California-based team, which includes Block and scientists from Stanford University and the Monterey Bay Aquarium, worked with the Cape Lookout Sportfishing Association (CLSFA) and the Duke University Marine Laboratory in Beaufort.

The results were quite successful. The two-week program was extended several

weeks as the weather cooperated, and the mature fish were biting.

"There were two hot spots for the bluefin tuna activity during TAG in Carteret County. The first was on the east side of Cape Lookout Shoals between the 1700 Rocks and the D Wreck," says Bill Hitchcock, president of CLSFA and a member of the North Carolina Sea Grant Outreach Advisory Board.

"The second area was just 6.5 miles southeast of Beaufort Inlet in the shallow waters around the Trawler Buoy," he says.

A Cape Lookout boat, trolling in areas 30 to 60 feet deep, would catch one or two giants per day in late December, but the catch increased in January.

In past years, a boat fishing for tuna in deeper water off Hatteras could catch up to 15 smaller, juvenile bluefin per day by "chumming," tossing chunks of menhaden as bait, Bahen says. In 1998 and early 1999, the bluefin catch off Hatteras was significantly lower.

Bluefin anglers brave winter weather to meet the

challenge of reeling in the giant fish. "It is something we have never seen here before. There is a tremendous pull — that's the thrill," Bahen says. Safety precautions include strapping the fisher into a chair during the catch.

On New Year's Eve, Ron Purser of Newport caught a nearly 600-pound bluefin while fishing aboard the *Delta*

Continued

Dawn, a charter boat owned by Peter Manual.

Crucial Data Gathered

Michael Orbach, Duke Marine Lab director, also knows the thrill of the catch firsthand. While assisting the research team, he pulled in two giants, including one at 410 pounds. But Orbach says the excitement from gathering research data on these large fish of breeding age is even greater.

The tagging effort is a cooperative venture for the scientific and fishing communities.

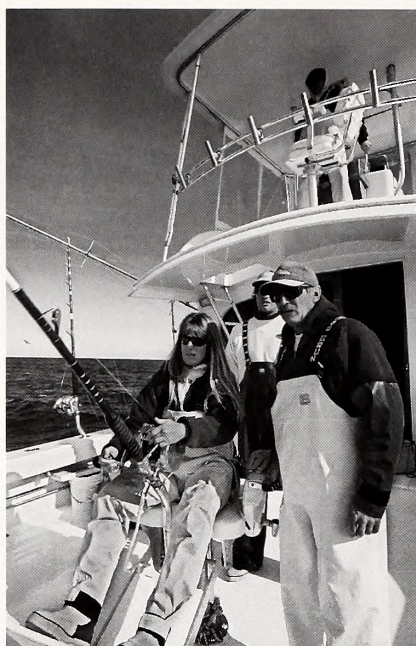
"This was an opportunity for the fishers to gain a better knowledge of these fish and for the scientists to learn more about our waters," Hitchcock says.

When a fisher catches one of the giants, the captain radios a surgical boat, which carries the researchers. The surgical boats include the *Calcutta*, owned by Jim Bailey and operated by Capt. John Jenkins; the *Bullfrog*, owned by Capt. Bob Eakes; the *Leslie Ann*, owned by Richard Whorly and captained by Gary Stuve; and the *Raptor*, owned by Jim Huddlestun and captained by Peter B. Wright.

Once the fish is transferred to the surgical boat, researchers implant an archival tag that will determine movement. The tag has an external sensor that can measure depth, light and external temperatures. When a tag is retrieved, researchers download the data to calculate the daily location of the fish and its diving activity.

Though expensive, an archival tag may provide data over several years, thus offering detailed migration patterns of western Atlantic bluefin tuna. North Carolina fishers assist the research efforts by paying for some of the archival tags, which cost \$1,500 each. Most tags are paid for with National Marine Fisheries funds and private grants.

The researchers also track tuna by



Fishers are strapped in for safety.

using pop-off tags, which are designed to stay on the fish for a preprogrammed time. The tag has a built-in corrosion point, which allows the tag to break off and float to the surface, transmitting its accumulated data to a satellite.

In 1996 and 1997, Block's team recovered data from 35 of 37 satellite tags. The scientists were able to track tuna that moved up to 1,670 nautical miles in 90 days. Some of these fish crossed the line that separates eastern and western management zones for the international bluefin fishery.

Socioeconomic Benefits Noted

The biological data from tagging programs are valuable. But catch-and-release programs offer great economic benefits to coastal communities even after the biologists have completed their projects.

Communities that encourage anglers to release their catch will not see their bluefin season hampered by landing quotas, says Robert Ditton of Texas A&M University, who studied the economic impact of the bluefin fishery in Hatteras.

In fact, Ditton's research suggests that charter captains charge more for anglers who want to take home the catch

because they are detracting from the long-term survival of the fish — and the sustainability of a bluefin season.

Scientific tagging is only one aspect of releasing fish. "Anglers will practice catch-and-release because they are intrinsically motivated," Ditton says. "Catch-and-release is a conservation statement."

North Carolina communities could consider this a marketing strategy. "Those who depend on the economic benefits of the Hatteras fishery need to make a greater effort to attract a new market segment of bluefin tuna anglers, namely those with more experience in bluefin tuna fishing and an appreciation for the catch-and-release experience afforded uniquely in the Hatteras area," Ditton recommends.

In 1997, bluefin anglers spent more than \$3.6 million in Hatteras, Ditton's study shows. A detailed census of those anglers showed 1,020 charter-boat and 370 private-boat tuna trips from mid-January through late March. And, Ditton points out, the 1997 season occurred with a minimum of regional, statewide or national publicity.

But the word about North Carolina bluefin is getting out to a wider fishing audience each year. "People are flying in from all over the world," Bahen says. ■

For information on the Cape Lookout Tag-a-Giant program in winter 1999-2000, contact Bill Hitchcock of the Cape Lookout Sportfishing Association at 800/251-1442 or check the group's Web site at <http://www.clsfa.com>. For information on the North Carolina bluefin fishery, contact Jim Bahen, North Carolina Sea Grant fisheries agent, at 910/256-2083.

On the Web, learn more about Barbara Block's bluefin research at <http://www.tunaresearch.org>. To learn more about Robert Ditton's socioeconomic study of the Hatteras bluefin fishery, check <http://lutra.tamu.edu/rbd/tuna.htm>.

Armchair Sailing

By Renée Wolcott Shannon

In like a lion, out like a lamb: March is unpredictable. Some days, the sand is like ice, and the wind off the Atlantic stings your cheeks red. Though summer is just around the corner, you can feel a long way from warm weather and your next sail up the sound. The slap of the waves, the glaring sun, the steady hiss of water along the hull. You miss the tug of the tiller in your hand or the quick response of the boat to the turning wheel.

For those with the sailing bug, boating is life itself, and the long winter months are a tough period of withdrawal. In this issue of *Coastwatch*, I've collected books that should help the last few weeks speed by quickly and help you prepare for your next boating season, whether you dream of sailing around the world or lazing away the summer on a towel and watching the boats on the bay.

• ***A Bride's Passage: Susan Hathorn's Year Under Sail*** by Catherine Petroski. 1997. Northeastern University Press, 360 Huntington Ave., 416 CP, Boston, MA 02115. 304 pages. Hardcover, \$42.50. ISBN 1-55553-298-5. Paperback, \$15.95. ISBN 1-55553-297-7.

History buffs will love this painstakingly researched tale of a new wife's 1855 ocean voyage. Susan Hathorn had just married her sea-captain husband when he whisked her away, and she recorded the details of their voyage in a yearlong diary. The original document is in the Special Collections Library at Duke University.



Portrait of Susan Hathorn, 1877,
from *A Bride's Passage*:
Susan Hathorn's Year Under Sail
by Catherine Petroski

You will admire Susan's bravery and wry humor as she comes to grips with life on a three-masted wooden bark; she tackles bedbugs, rats and pitching seas with equal aplomb.

Petroski knits Susan's diary together with other documents of the era to illuminate a fascinating life. In her introduction, Petroski tells us that Susan came from a farm family in

Maine and attended the new Mount Holyoke Seminary; her husband, Jode Hathorn, came from a line of prosperous merchants and shipbuilders.

Susan had never been to sea before Jode asked her to accompany him to Cuba and England on a trading voyage only a month after they were married. Her ability to adapt and work under all conditions keeps her saga fascinating to the end.

Petroski takes you through the diary month by month, quoting passages that display Susan's Victorian sensibilities and dry wit. Though Petroski's style is somewhat academic, she shows real affection for her topic and combines solid facts with a flair for detail.

She doesn't hesitate to pass along Susan's sense of humor in adversity: "Had a regular 'bed bug slaughter' this morning," reads one quoted passage. "Found the things in the sofa — under the buttons — a nest under each one. What I shall do with the cock roaches now, is a question of great moment with me. They are fairly taking possession of my quarters."

Susan is a woman of considerable power for her time. She knits and sews like any good Victorian wife, but she also takes position readings at sea, tends injured sailors, shops for her family and keeps the books for the voyage. For more than half the journey she is pregnant, but she forges ahead without complaint.

By the end of the book, you appreciate what it might have been like

Continued

to be this extraordinary woman, traveling the high seas a century and a half ago. Illustrations and appendices help make a firm connection to her life, and Petroski's writing skillfully describes the social customs, ships and navigational methods of the time. I was sorry to read the last pages and to wish Susan farewell.

• **Henry the Sailor Cat** by Mary Calhoun, illustrated by Erick Ingraham. 1994. Mulberry Books. William Morrow & Co., 1350 Avenue of the Americas, New York, NY 10019. 38 pages. Paperback, \$4.95. ISBN 0-688-15846-3.

Younger readers and cat fans will appreciate the gentle humor and high adventure of Calhoun's *Henry the Sailor Cat*, lavishly illustrated by Ingraham. Henry, a daring Siamese, stows away on a sailing lesson for "The Kid" and helps save "The Man" when he falls overboard. The suspenseful action provides a natural way for parents to discuss boating safety and the importance of listening to directions.

Both the text and the illustrations convey the joy — as well as the possible dangers — of sailing. In Ingraham's beautiful watercolors, we see the changing moods of ocean weather, the deep affection between a father and his son, and the playful antics of dolphins and a clever Siamese.

Ingraham seems well aware of the necessity for boat safety, too: "The Man" and "The Kid" are outfitted in smart red and yellow life preservers, and Ingraham dedicates his work "to all boating enthusiasts who obey water safety rules." Here is a book that both parents and kids will applaud.

• **I Don't Do Portholes** by Gladys Walker and Iris Lorimer, illustrated by Peter Wells. 1986. Westcott Cove Publishing Co., Box 130, Stamford, CT 06904. 108 pages. Paperback, \$9.95. ISBN 0-918-752-06-X.

For those who actually brave the

waves, the 387 "Super Boatkeeping Tips" collected in this informative and entertaining book could be a lifesaver. The authors speak with authority as longtime boaters, and they've split their tips into useful categories like "Carrying and Stowing," "Outfitting the Galley" and "Boating with Children." You'll get helpful hints on ways to save space, reduce waste and make your boat safer and more comfortable to live in. A few examples:

- *Tip 28:* "Two-inch PVC tubing, cut into appropriate lengths and fastened securely to the cabin overhead (ceiling) or stored elsewhere, can be used for chart storage."
- *Tip 113:* "Whenever possible use a plastic bag instead of a mixing bowl. Blend ingredients by kneading them. It eliminates washing a bowl and utensils."
- *Tip 369:* "Print step-by-step instructions for using your radio and tape them right to the set. You never know who might have to make an emergency call."

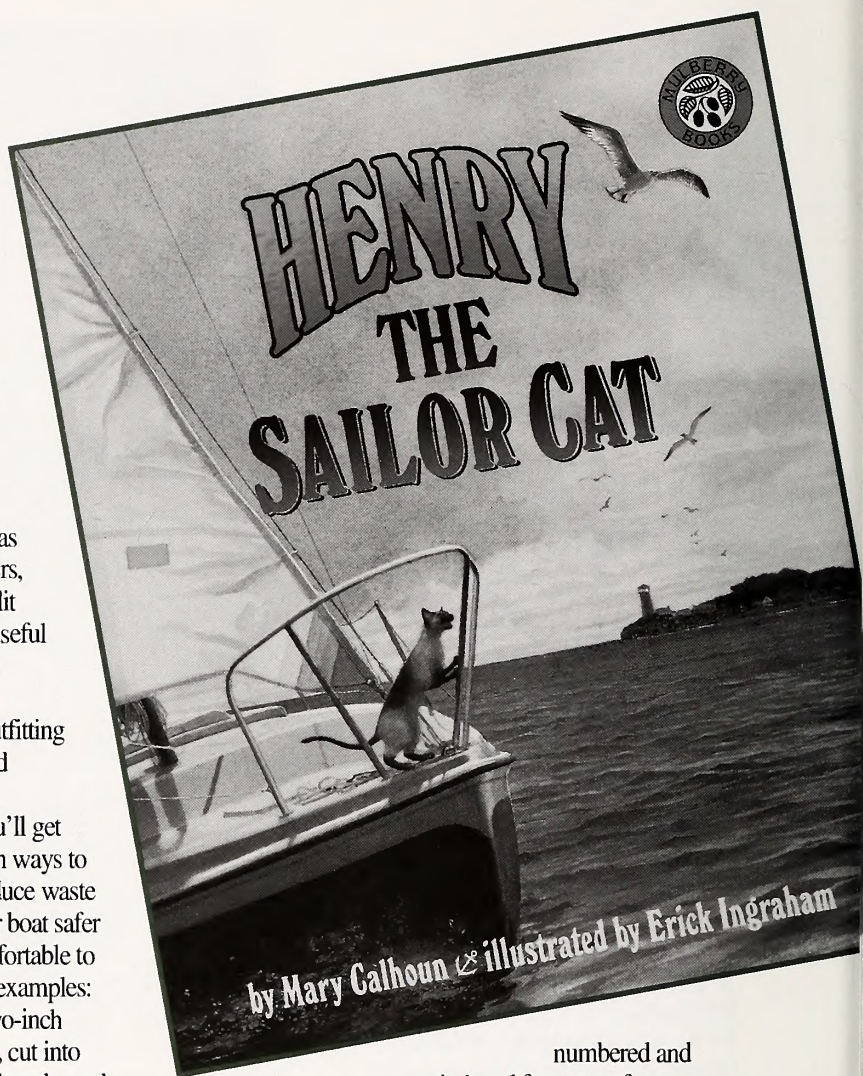
The book also offers quick recipes and water-saving methods and suggests products that are useful to have onboard. Some of these hints are now outdated ("Boaters are hailing the introduction of UHT milk ..."), but the products listed are as helpful as ever. All the tips are

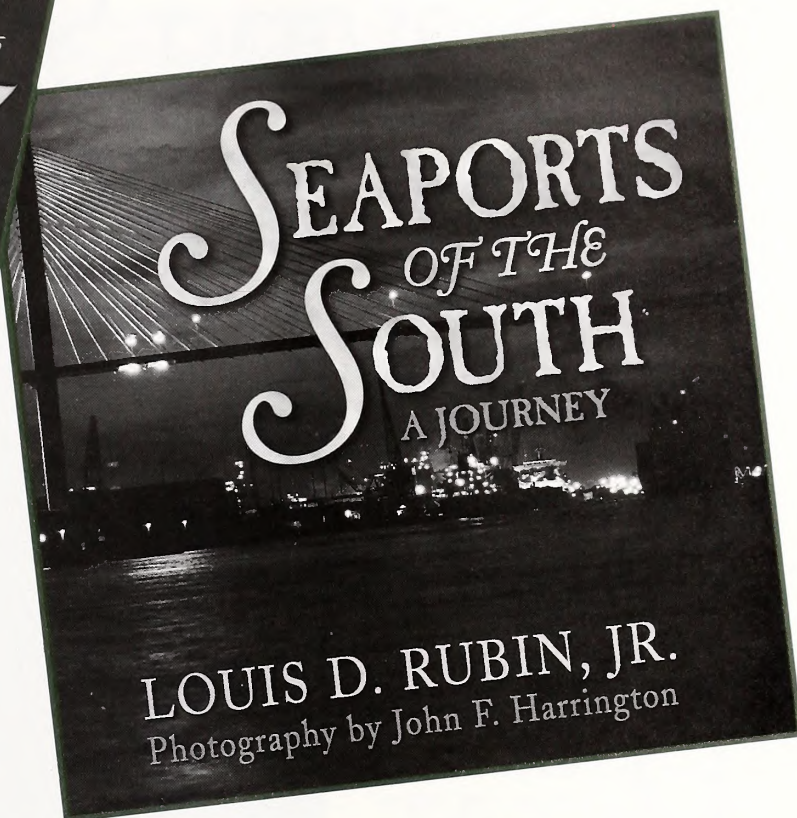
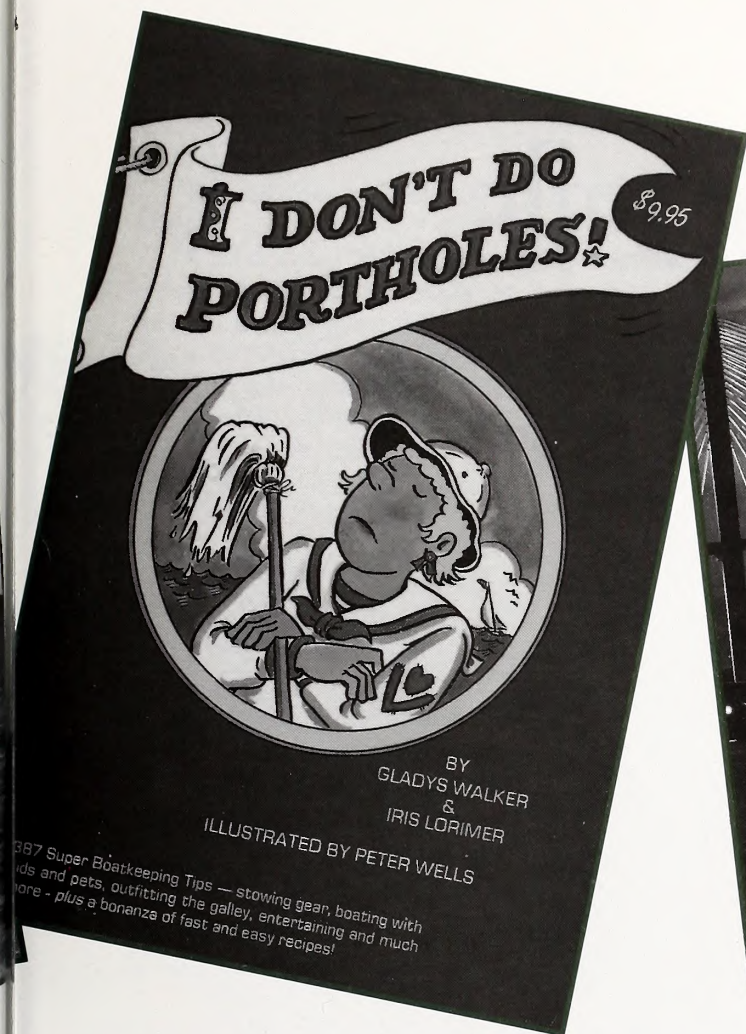
numbered and indexed for easy reference.

The authors' humorous style, combined with the illustrations of widely known cartoonist (and fellow boat owner) Wells, make the book a pleasure to read. If you want to jump-start your boating season by organizing supplies and planning ahead, this book will be infinitely helpful. It even has a checklist for all your boating needs, from the bare necessities to bedding and linens and emergency stores. *I Don't Do Portholes* deserves a place on any serious boater's bookshelf.

• **Seaports of the South: A Journey** by Louis D. Rubin Jr., with photography by John F. Harrington. 1998. Longstreet Press, 2140 Newmarket Parkway, Suite 122, Marietta, GA 30067. 268 pages. Hardcover, \$25. ISBN 1-56352-499-6.

If the sheer size and huge horsepower





of a tanker, cruise ship or container ship get your engines throbbing, then this could be the book for you. Rubin, who achieved fame in North Carolina as founder of Algonquin Books, leads readers on a tour of 13 Southern seaports. Harrington, his lifelong friend, provides colorful photographs of the enormous ships to which they devote themselves.

A kind of oceangoing road trip, the book is a succession of boat rides, restaurant meals and tankers looming out of the mist. Rubin and Harrington manage to talk their way onto tugboats in almost every port, and Rubin takes delight in listing the lengths, drafts, widths and horsepower of the vessels they spot. You'll learn much about the boats and discover the complex international flavor of deep-sea shipping — the Greek-owned ships based in Liberia carrying lumber from Mobile, Ala., to Norway under the watchful eyes of a Filipino crew.

In the first glossy pages, you'll

accompany the self-described "elderly ship fanciers" as they help dock ships at the Wando Terminal in their hometown of Charleston, S.C. In later chapters, you can watch paper being loaded in Wilmington, dodge a hurricane in New Orleans, catch a helicopter ride to an offshore oil-pumping station in Louisiana and tour a nuclear submarine near Jacksonville, Fla. Along the way, you'll learn how each seaport's fortunes rose and fell over the course of history.

Rubin's narrative also imparts local color. Wilmington, for example, is famous for its lumber trade, while Savannah, Ga., is one of the world's biggest exporters of kaolin, a fine white clay used in porcelain and for coating paper.

Engineers made Corpus Christi, Texas, a powerful shipping center by dredging a canal and excavating a 3,000-foot harbor for the city. In Houston they had only to enlarge an existing bayou. Still,

water traffic there and in New Orleans is so busy and complex that observation towers and control rooms must be used to monitor the ships.

In Pascagoula, Miss., the author tours a National Oceanic and Atmospheric Administration fisheries facility and learns about bottlenose dolphin research. Rubin also describes the "ecological nightmare" of Tampa Bay, Fla., which is slowly being reversed through the Tampa Bay National Estuary Program.

You will come away with a good sense of the history and importance of each of these cities and of the oceangoing traffic that constantly shuttles into and out of wharves and docks. The only flaw in this remarkably informative book is some shoddy editing. Typos abound, and one chapter ends abruptly in midsentence, never to be completed. I can't imagine that Rubin, himself a famed editor, is very happy with his publishers. □

Saving Snails...

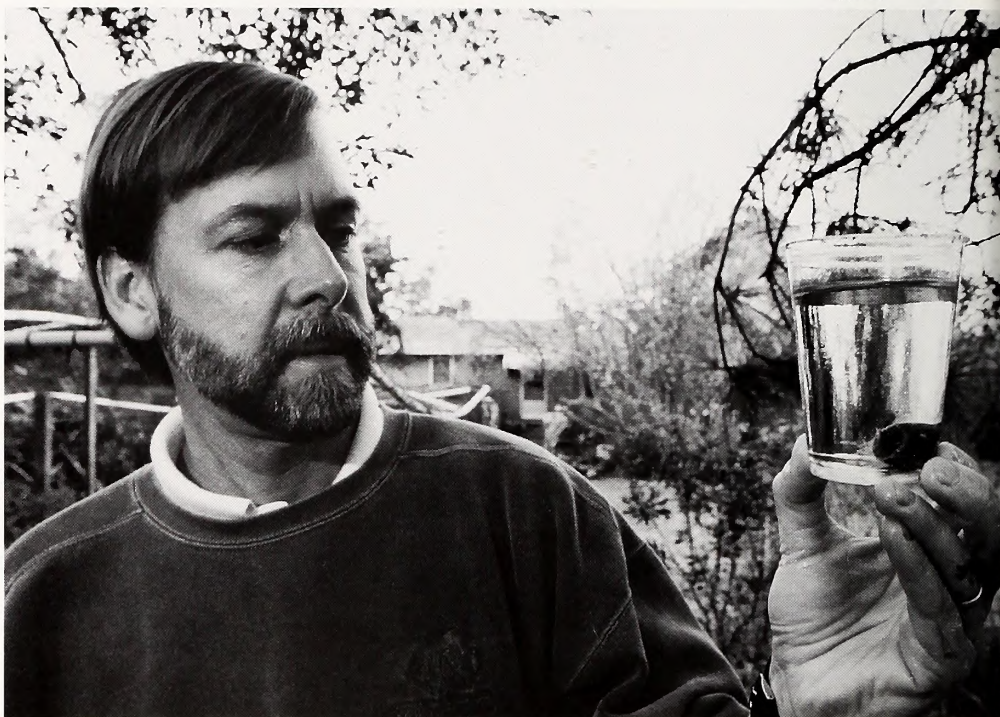
*and other
steps toward
a healthy
planet*

By Odile Fredericks

Despite the clutter in his office at the N.C. Aquarium at Fort Fisher, Andy Wood seems to know where everything is. Reconstructed fossil bones compete for attention with pieces of driftwood from the beach outside, frog-crossing signs, stacks of books and tanks of water where he's creating habitats. A telescope lets him keep a watchful eye on the ocean. From his window, he monitors the loading of alligators that he'll take to Florida tomorrow.

Order exists amid the chaos, as in the natural world. Education curator for the aquarium, Wood is a lifelong environmentalist who works quietly to rectify the damage he sees destroying the planet. His penchant for stewarding the smallest of creatures reveals his philosophy that everything is interconnected.

"Unlike most people's perceptions, the dominoes begin to fall with the little teensy things that you don't see," says Wood, who carries a beeper at all times so he can be available to callers with environmental concerns.



Andy Wood admires the magnificent rams-horn snail, a species that may be confined to his back yard.

For Wood, activism is a way of life that begins in his back yard. Six years ago, when a friend in the U.S. Army Corps of Engineers asked him to take in some vulnerable snails, he agreed. Today, his yard may be the breeding ground for the last of the magnificent rams-horn snails. No more than an inch and a half long, the snails are on the state's endangered species list and could be federally listed if Wood's research pans out. A freshwater creature, the snail is sensitive to changes in salinity.

"It's now possible that it is no longer in the wild, which means the entire species is in my back yard in captive propagation," he says.

Once thought extinct, the magnificent rams-horn has been found in the wild in only two locations, both in southeastern North Carolina, says Bill Adams, a

biologist with the Corps of Engineers in Wilmington, who rediscovered the snails about 20 years ago. And it is possible that the snails may now have disappeared from these locations since no one has been able to verify their existence there lately.

The principal investigator for a U.S. Fish and Wildlife Service propagation study of the snails, Wood has spent the past few years trying to find out what they need to survive. Their demise, he believes, is linked to the disappearance of their habitats, which concerns him. By the mid-19th century, the beaver ponds where they used to live practically vanished as beaver populations dwindled due to trapping. Now development encroaches on the freshwater ponds where the snails were also found, and runoff from construction changes the surrounding landscape.

The snail is just one of Wood's protégés.

A self-described "bleeding heart environmentalist," he has a tendency to apologize for sermonizing and then get right to it. He believes man's self-centered, myopic attitudes are destroying wildlife while blinding us to the ways that animals recharge the environment. Beaver dams, while they flood farmlands, also create some of the most fertile soils, he explains.

His untiring voice is one reason the National Marine Educators Association gave him the James Centorino Award for distinguished performance in marine education last year.

"I talk a lot to anyone who will listen. I preach," he says. "What literally motivates me is the thought of this planet 20 years from now, and the children — including my 9- and 11-year-old sons — and what they will have. This planet is our only home ... and so long as we continue to abuse it, we are making our bed that we will have to sleep in."

For as long as he can remember, Wood wanted to be a naturalist like his father and two generations who preceded him. Born in Washington, D.C., Wood grew up in Weston, Conn., close to a nature center where he spent every moment of his free time — he hitchhiked to get there when he couldn't drive. As a child, he took part in the center's programs. As a teen, he was summer manager of the animals in the 54-acre sanctuary.

In 1970, at age 15, he was involved in the first Earth Day celebration. He also was one of Ralph Nader's Raiders, a group of teens old enough to testify in court but young enough not to go to jail for trespassing as they gathered evidence of environmental misdeeds. Working with a college student, Wood sneaked onto the grounds of a paint factory to take pictures of paint being discharged into the Housatonic River in Connecticut.

"There was some clandestine activity involved here, which made it all the more romantic for a 15-year-old," he recalls. "Eight years later, the court case finally

was settled, and if I recall correctly, it was about a \$12 million settlement. But the pipe had been closed off years before that."

In 1974, Wood entered Texas A&M University, where he had thought he would follow his childhood dream of studying herpetology. When he learned the university didn't offer the degree, he began to explore other avenues, discovering new interests from animal anatomy to geology and botany. Meanwhile, his job caring for rattlesnakes and other reptiles at a university research center kept him in touch with his past.

By the time he graduated in 1981 with a bachelor of science degree in wildlife and fishery science and conservation, he had a well-rounded education, which prepared him for the diverse routes he would follow. He worked free-lance as a natural science instructor and sought to protect birds of prey through another job in San Antonio, Texas. Soon afterward, he met his wife, Sandy, in New Mexico, where she was on an exchange program from North Carolina State University.

It was love at first sight, he recalls. A year later, he followed her back to Raleigh, where he was summer camp director at the N.C. Museum of Natural Sciences. Later he worked with the Raleigh Parks and Recreation Department and then for the NC State College of Veterinary Medicine, reconstructing skeletons that ranged from a mouse to a giraffe for anatomy classes.

The couple married in 1984, and a year later, Wood was connected with the Fort Fisher aquarium through a job as director of a summer science camp for UNC-Wilmington. Since becoming the aquarium's education curator in 1987, he and his staff have broadened the scope of programs offered to the public.

The aquarium now teaches surfing. He figures it is the only public aquarium in the United States to do so. "We do it because surfing appeals to a group of people who might not otherwise participate in our conservation/education-based programs," he says.

The programs, which range from crabbing to "scaly stories" for children, are just one avenue to get the message out. For Wood, most days are frenetic because he puts himself at the disposal of the public, and his hands are in so many pots.

Good days are when he can get outside to lead a field trip on the neighboring beach or salt marsh. A lot of the time, he's fielding calls on environmental issues from the media, homeowners and city or county planners. Following his cause often takes him beyond regular work hours.

As a regional coordinator, he helped North Carolina Sea Grant launch the first Beach Sweep cleanup. And for more than a decade, he's been a weekly natural history commentator on WHQR, Wilmington's National Public Radio affiliate.

In 1990, to mark the 20th anniversary of Earth Day, he founded the Earth Day Alliance of the Lower Cape Fear, bringing together environmental groups, business leaders and concerned citizens to speak more cohesively on environmental issues.

In the past two years, he's worked to amend a plan to convert a sandhills longleaf pine habitat owned by the city of Wilmington into ball fields.

"The perception right now is the only valuable land in North Carolina is wetland, and that's just not true," Wood says. "We have to be as diligent about protecting our dry land because that's where much of our rain falls. And if we cover over our dry lands with impervious asphalt and concrete, that water just runs off and doesn't recharge aquifers, and it pollutes our streams and lakes and then our salt marshes and ocean, and ultimately, us."

Wood's dedication overrides everything, says Corps of Engineers biologist Adams, who has known him for 10 years.

"I think he would take vows of celibacy and poverty if he thought it could protect the environment better," he says, laughing. "That's one of the things that makes Andy unique." ■

Crabby Fare

By Kathy Hart

I'm a glutton for all species of seafood, but if forced to choose a favorite I'd have to say the succulent meat of the blue crab reigns king of the sea on my plate. The moist, flaky morsels of meat have a delicate sweetness that is rich and rarefied. No other crab — not Dungeness, snow, stone or king — can quite measure up in flavor or texture.

But perhaps my affinity for the blue crab is more than good taste. My first ocean catch some 20-plus years ago was a blue crab, scooped up with a handheld net after patiently dangling a chicken neck on a string in Topsail Sound. I was fascinated by the feisty crustaceans, and it wasn't long before I was helping my friend Beverly Mills bait and later empty her family's two crab pots.

What naturally followed — the aroma of crabs being steamed with packets of fragrant spices — became another sensory delight that I fondly associate with the Tar Heel coast. Beverly's mother would dump baskets of steaming orange crabs (the crabs turn from blue-green to a bright orange during cooking) onto a newspaper-covered table for us to clean.

The ensuing picking — the extraction of the lumps of sweet meat from the crab's claws and compartmentalized body — was a labor of love. You had to really love crabmeat to labor so much for a pound of it.

For me, it was worth it. You can't beat crab cakes chock-full of fresh crab and held together with a scant amount of breading and a few eggs.

These days I rarely catch my own, choosing instead to occasionally splurge \$12 to \$16 for a pound of fresh crabmeat or \$8 to \$10 for an 8-ounce

container of pasteurized meat. The fresh crab should be used quickly, usually within two days of purchase. Crabmeat has a short shelf life and will spoil quickly. Unopened pasteurized crabmeat can be stored for up to six months in the refrigerator. But once opened, it too should be consumed quickly.

To me, fresh crabmeat is always best. It's more flavorful and moist than meat that has undergone the additional processing step involved in pasteurization. But the pasteurized meat is a close second and often a cheaper option since it's sold in smaller containers.

Generally, fresh and pasteurized crabmeat is marketed and priced according to three grades: lump, special and claw.

Lump, also called backfin, is always the most expensive and contains only large chunks of snow-white meat taken from the body of the crab. Lump meat is used in recipes where appearance is important, such as in cocktails or salads.

Special contains smaller pieces of meat taken from the body of the crab. It's just as tasty as the lump and is used in soups, casseroles and baked dishes. It is moderately priced.

Claw meat is tinged brown and, as the name suggests, is extracted from the crab's claws. It is the least expensive and is used in recipes such as casseroles or stuffing where appearance isn't important.

Most crabmeat is handpicked, but some is mechanically extracted. Before using any crabmeat in a recipe, you should place it in a bowl and sift through it with your fingers for several

minutes to remove any shell or cartilage.

Following are some of my favorite crabmeat recipes — ones that I've developed because of my hunger for the sweetness of the cooked crustaceans.

Crab Ball

- 6 to 8 ounces of fresh, pasteurized or canned crabmeat
- 1 8-ounce package cream cheese
- 1/4 cup seasoned bread crumbs
- 1 teaspoon horseradish sauce
- 1 teaspoon Worcestershire sauce
- 1 clove garlic (pressed)
- Seafood Sauce (recipe follows)

Combine crabmeat, cream cheese, bread crumbs, horseradish sauce, Worcestershire sauce and garlic. Form into a ball and refrigerate overnight to allow flavors to blend. Before serving, pour sauce over ball. Serve with crackers.

Seafood Sauce

- 1/2 cup ketchup
- 2 tablespoons horseradish sauce
- 1 tablespoon lemon juice

Carolina Crab Cakes with Creamy Horseradish Sauce

This recipe appears in Desperation Dinners, a cookbook published by Workman Publishing and written by Alicia Ross and my friend Beverly Mills. Mills asked me for a recipe that could be prepared and cooked in 20 minutes — the criteria for all of the recipes published in the book. I immediately thought of this one, which uses the crabby crustaceans she had introduced to me many years ago at Topsail Beach.



Scott D. Taylor

- 1 8-ounce container of pasteurized crab claw meat
- 1/2 cup chopped onion
- 1/2 cup chopped green pepper
- 6 tablespoons margarine
- 2 large eggs
- 1/2 cup plain dry bread crumbs
- 1/4 cup reduced-fat mayonnaise
- 2 teaspoons Worcestershire sauce
- 1/2 teaspoon freshly ground black pepper
- 1/4 teaspoon salt
- Creamy Horseradish Sauce (recipe follows)

Place crabmeat in a medium mixing bowl. Sift through the meat with your fingers to remove any shell or cartilage.

Over medium heat, sauté onion and green pepper in 2 tablespoons of margarine until soft, about 8 minutes. Add to crabmeat. Add eggs, bread crumbs, mayonnaise, Worcestershire sauce, black pepper and salt. Stir to combine.*

Melt remaining 4 tablespoons of margarine in a skillet over medium heat. Meanwhile, using your hands, shape the crab mixture into patties about 1 inch thick. Drop into skillet.

Fry patties until golden on one side, 3 to 4 minutes. Turn and repeat on the other side. Remove from skillet and serve with a dollop of creamy horseradish sauce. Serves 4.

Creamy Horseradish Sauce

- 1/2 cup reduced-fat or no-fat sour cream
- 1 tablespoon horseradish
- 2 teaspoons Dijon mustard

Combine all ingredients in a bowl and stir to blend well.

** If you don't want fried cakes, you can also use this mixture to fill the caps of large, cleaned mushrooms or the pocket of medium-sized flounder prepared for stuffing.*

Crab Omelets

- 6 ounces of fresh or pasteurized crabmeat
- 1 large onion, chopped
- 1 8-ounce package of sliced mushrooms
- 4 tablespoons margarine
- 6 eggs
- 1 cup of grated cheddar, swiss or hot pepper jack cheese
- 1 avocado, peeled and diced

Place crabmeat in a medium mixing bowl. Sift through the meat with your fingers to remove any shell or cartilage.

In a nonstick skillet over medium heat, sauté chopped onion and sliced

mushrooms in 2 tablespoons of margarine until softened, about 8 minutes. Remove the sautéed onion and mushrooms to a medium bowl.

Return skillet to heat and melt 1 tablespoon of margarine. Meanwhile, break 3 eggs into a 2-quart bowl and beat with a whisk until light and frothy. Pour the eggs into heated skillet and cook, without stirring, until the edges are set and the middle is only slightly runny, 3 to 4 minutes.

Working quickly, add 1/2 of the sautéed vegetables to one side of the omelet. Top with 1/2 of the crabmeat, 1/2 cup grated cheese and 1/2 of the diced avocado. Using a wide spatula, fold the plain half of the omelet over the filled half. Slide the omelet onto a plate.

Repeat process with remaining eggs, margarine, sautéed vegetables, cheese, crabmeat and avocado.

Makes 2 large omelets. Or divide each large omelet in half to make four smaller servings. ■

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F r o m t h e E d i t o r

Carson in Carolina

Rachel Carson had homes in Maine and Maryland, but she apparently had a soft spot for North Carolina as well.

In her writings, she eloquently describes our coastal life and landscape — the formation of shoals off Cape Lookout, the spectacular image of whistling swans at Lake Mattamuskeet and the saga of mollusks whose shells we find scattered along Cape Hatteras. But her North Carolina legacy is more than a footnote.

The Rachel Carson site, part of the North Carolina National Estuarine Research Reserve, is a string of islands across from historic downtown Beaufort. Tourists marvel at the islands' horses. Families and school groups take day trips to the reserve to learn about the life cycles and habitats of our crucial estuary system.

Before visiting the reserve, pick up Carson's *The Edge of the Sea* and *The Sea Around Us*. Chapters lead you to "The Rim of Sand" and "The Coral Coast" and offer glimpses of "Hidden Lands" or "The Moving Tides."

Glimpses into Carson's personal life are harder to come by, but *A Sense of Wonder: A Play Based on the Life and Works of Rachel Carson* offers insight on the woman best-known for *Silent Spring*, her book on the dangers of pesticides. The one-woman play, written and performed by Kaiulani Lee, was crafted from Carson's letters, diaries and books.

Although Carson attended college in the 1920s, her words still strike a chord with high school and college students. Dozens attended a performance sponsored by the Center for Environmental Education at Duke University.

Carson was more than a scientist, explains Jenni Giles of Apex High School. "She strived to be a woman who was a part of nature."

The performance touched adults as well. Durham City Council member Pam Blyth says Carson's works reinforce how urban

Herman Lankford



planning decisions have impact downstream. For example, the Neuse River flows from Falls Lake in the Triangle to the Pamlico Sound.

Carson's love of the sea blossomed with her first glimpse of the waters at Woods Hole, Mass. But Carson kept a focus on her family, caring for aging parents and raising two nieces on her salary as a marine biologist and, later, as editor-in-chief at the U.S. Fish and Wildlife Service.

The play is set when Carson is in her 50s. While battling cancer, she responds to the high praise and harsh criticism of *Silent Spring*. She also raises her great-nephew, Roger, whom she adopts after both his parents die. Young Roger's eagerness to enjoy the sea helps Carson keep alive her own sense of wonder.

We think that *Coastwatch* helps rekindle your "sense of wonder" about the sea and sounds, dunes and coastal plain. When you share *Coastwatch* with friends, family and co-workers, the wonder spreads like a rippling wave. Extend that wave by sending a gift subscription to a special person, or to a local school or senior center.

In this issue, we look at the past and the future of human life along the shore. Julie Ann Powers finds whispers of history in the abandoned village of Portsmouth. Renée Wolcott Shannon ponders the emerging practice of water-use zoning, and photographer Michael Halminski shows the preparations for the movement of the Cape Hatteras lighthouse.

We look at nature as well. Ann Green takes readers to the North Carolina Estuarium, while I tell of a new network to save stranded whales. Odile Fredericks shares a treasure trove of coastal wildflowers, while Shannon describes the tasty Atlantic bonito.

What inspires your sense of wonder at the coast? Drop me a note or e-mail — kmosher@unity.ncsu.edu. You could inspire a future story. ▣

Katie Mosher, Managing Editor

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports several research projects, a 12-member extension program and a communications staff. Ron Hodson is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina. *Coastwatch* (ISSN 1068-784X) is published bimonthly, six times a year, for \$15 by the North Carolina Sea Grant College Program, North Carolina State University, Box 8605, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095. E-mail: kmosher@unity.ncsu.edu. World Wide Web address: http://www2.ncsu.edu/sea_grant/seagrant.html. Periodical Postage paid at Raleigh, N.C.

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Front cover photo of the Styron-Bragg house in Portsmouth and table of contents photo of beach-goers at Fort Macon State Park by Scott D. Taylor.

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COASTAL TIDINGS

Tackling the Threat of Exotic Species

North Carolina is under attack by aliens. Alien nuisance species, that is: plants and animals that are not native to our ecosystems and whose invasions of our sounds and rivers can prove costly.

The Invasive Species Council, created this year by an executive order from President Clinton, marks federal awareness of the mounting threat from exotic species. North Carolina Sea Grant is already doing its part to protect our state from these alien invaders.

Barbara Doll, water quality specialist for North Carolina Sea Grant, emphasizes the state's vulnerability. One threat lurks just to the north, in the lower Chesapeake Bay. In recent months, researchers there have discovered the veined Rapa whelk, which is native to the Sea of Japan. The large whelk eats hard clams, sucking out the body and leaving the shell empty.

"It could come here," says Doll. "It may be here already. It likes hard sand bottoms and it likes hard clams, and we've got those."

In an effort to prepare our part of the country to fight the whelk and other aquatic nuisance species, North Carolina

Sea Grant is co-sponsoring a regional conference on exotic species Oct. 12-14. Sponsors include the Tennessee Valley Authority, the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, other Sea Grant programs in the Southeast and natural resource managers from several states.

The Charleston, S.C., conference will focus on a region that extends from North Carolina to Florida and west through the Gulf Coast of Texas. "The Southeast is an area that's never been looked at," Doll

says. The conference will discuss existing problems with exotic species in the region and identify possible new invaders. Participants also will discuss state policies and regional efforts that would help stop the spread of aquatic nuisance species.

"We don't have a cooperative agreement with other states in the region," says Doll, yet North Carolina's waterways drain into South Carolina and Tennessee. The conference, "Aquatic Nuisance Species: A Focus on the Southeast," will help the region present a united front against future invasions.

— R.W.S.



Juliana Harding/Virginia Institute of Marine Science ©

In the Next Issue of *Coastwatch*

The Cape Fear River has long been a watery highway for North Carolina's fishers and tugboat captains. In the next issue of *Coastwatch*, T. Edward Nickens takes a boat ride through Cape Fear River history and explores the importance of this artery of commerce. To the north, Ann Green visits Pettigrew State Park, where majestic bald cypress trees offer a glimpse into an area once dominated by swamplands. The park is home to Lake Phelps, the state's second largest natural lake and an angler's paradise. Green also delves into the secrets of the crafty blue crab with researcher David Eggleston, who has new findings on North Carolina's most profitable catch.

Fishery Resource Projects Selected

Sixteen new projects — ranging from studies of blue crab and eel health to efforts to improve the safety and shelf life of fish fillets — have been approved for funding through the state's Fishery Resource Grant Program.

The projects, totaling about \$500,000, were selected recently by the N.C. Marine Fisheries Commission. The Fishery Resource Grant Program, the first of its kind in the nation, is funded by the North Carolina General Assembly and administered by North Carolina Sea Grant.

Another request for proposals is expected this summer.

The program was created to highlight the intuition and innovation of those who make a living on or near the water. Grants target commercial or recreational fishers, seafood processors and others involved in fishing industries. Other applicants need participation with and endorsement from industry representatives.

Fishers are encouraged to work with academic researchers to increase the scientific validity of the projects. North Carolina Sea Grant, with its tradition of funding scientific research that can be transferred to use in coastal communities, often facilitates the link.

"We are seeing more partnerships between academic and industry persons than in the past. I believe this is good for the program," says Bob Hines, a North Carolina Sea Grant fisheries specialist and Fishery Resource Grant coordinator.

"I'm looking forward to working with this year's grant recipients," he adds.

Since the program was created in 1994, 156 projects have been funded. All regions of the North Carolina coast have been represented.

A total of 57 proposals were submitted in January. The 16 projects selected represent four main categories: fishery equipment and gear, aquaculture and mariculture, environmental pilot projects, and seafood technology.

To learn more about a 1998 Fishery Resource Grant that developed a North Carolina network to assist whales tangled in fishing nets, turn to page 26.

For more information, or to apply for the Fishery Resource Grant Program, call Hines at 252/247-4007, or the Sea Grant office in Raleigh, 919/515-2454. To review a list of past projects, check the Web at www2.ncsu.edu/sea_grant/frgpage.html.

— K.M.

Foiling Oil Spills

This year marks the 10th anniversary of the environmentally disastrous Exxon *Valdez* oil spill in Prince William Sound, Alaska. The wreck of the *Valdez* pumped 11.2 million gallons of oil into the water and left a legacy of habitat degradation that lingers today.

In the early 1980s, North Carolina Sea Grant and the North Carolina Biotechnology Center supported research that studied corn slash as a means of absorbing spilled oil. Corn slash is the plant material left in the field after the corn is harvested.

Hans Paerl, a researcher from the University of North Carolina at Chapel Hill, tested the usefulness of corn slash in experimental spills in outdoor ponds. He found that the corn material absorbed the oil and had an additional benefit: it provided a good substrate for bacterial growth, and the bacteria helped speed the natural breakdown of the oil.

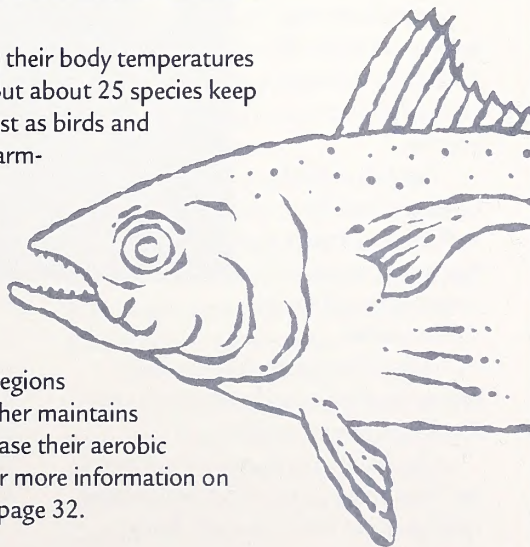
The corn slash also answered a problem that often goes hand-in-hand with oil-spill cleanup. When using biodegradation techniques, cleanup teams often have to fertilize the water with nitrogen so that the oil-eating bacteria can survive. Using the corn slash allowed the bacteria to produce their own nitrogen through nitrogen fixation.

Though corn slash would be no match for spills like the *Valdez*, techniques like this one could be extremely useful in small, confined oil spills in marinas or marshes.

— R.W.S.

Warm-Blooded Fish

Most fish are cold-blooded, meaning their body temperatures fluctuate with the surrounding water. But about 25 species keep their eyes, brain or entire body warm just as birds and mammals do. All species of tuna are warm-blooded, as are some mackerel and billfish such as marlin and swordfish. Scientists have two competing theories about these fishes' thermal abilities. One maintains that the fish developed their warming capacity to expand their ranges into colder ocean regions that offered more food sources. The other maintains that the heating allows the fish to increase their aerobic capacity so they can be more active. For more information on two look-alike warm-blooded fish, see page 32.





New Web Site Opens Window on Coastal Hazards

Want guidelines on protecting your roof during a hurricane or tips on storm shutters? How about access to disaster experts or data on major hurricanes? All of this information is available online at the new Sea Grant HazNet site, a national information network focusing on coastal hazards awareness, research and outreach programs.

To help people meet the challenges of natural disasters — from floods and coastal erosion to storm surges and hurricanes — the site provides information and resources from Sea Grant, the National Oceanic and Atmospheric Administration and other sources.

Consumers can access basic information about coastal hazards as well as detailed reports, including one on the building codes and practices in south Florida since Hurricane Andrew.

The project aims to “enhance the contributions of the Sea Grant network in the national effort to reduce the adverse impacts of natural hazards, including loss of life, economic losses and social disruptions,” says South Carolina Sea Grant Extension Program Leader Bob Bacon, who oversees the site.

Visit the HazNet Web site at www.haznet.org. — A.G.

Salt Marsh Restoration Improves Coastal Habitats

Along North Carolina’s coast and across the country, salt marshes have disappeared at an alarming rate during the past century.

Because salt marshes are of paramount ecological importance, researchers have developed a number of restoration techniques — from removal of fill to planting new salt marsh vegetation.

These restoration techniques are summarized in the new publication *Salt Marsh Restoration: Coastal Habitat Enhancement* by B.J. Copeland, former director of North Carolina Sea Grant. The publication was funded by the National Sea Grant Program, North Carolina Sea Grant and the National Oceanic and Atmospheric Administration Coastal Ocean Program.

“I want to show that — after 30 years of research by scientists like Steve Broome

of North Carolina State University — it is possible to restore fundamental coastal habitats,” says Copeland, professor of zoology and marine sciences at NC State.

“To restore marshes, you need to pay attention to details. I hope the publication will help coastal managers find new ways to mitigate salt marshes.”

To help managers understand restoration techniques, the booklet is packed with photos and drawings. Guidelines are given for site selection and site preparation, establishing vegetation and cultivation and maintenance. To gauge success, the last section gives advice on landscape assessment and monitoring.

To order your free copy of *Salt Marsh Restoration*, call North Carolina Sea Grant at 919/515-2454, e-mail harriss@unity.ncsu.edu or fax your request to 919/515-7095. — A.G.

Beach Strolls Yield Simple Treasures

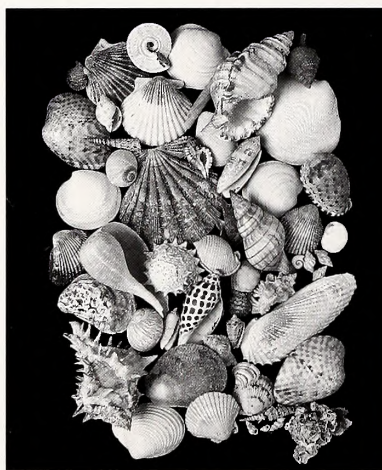
The search for seashells can delight beachcombers of all ages. Identifying these treasures adds to the excitement of the hunt.

In fact, summer beach adventures offer the perfect opportunity for hands-on learning.

Seashells of North Carolina is ideal for a shell-hunter’s beach tote — and would make a great gift for a special teacher.

This 132-page book offers background on bivalves and gastropods and tips for the serious collector.

To identify a shell, readers can turn to the “descriptive guide to families” section which leads to entries for each family.



Scott D. Taylor

The book contains details for more than 250 shells found in North Carolina. Size, description and habitat are noted, along with black-and-white photographs. The book also includes 30 color photographs.

The award-winning *Seashells of North Carolina*, written by Hugh J. Porter and Lynn Houser, is

available for \$12 per copy. To order, make your check payable to North Carolina Sea Grant. Mail your request to North Carolina Sea Grant, North Carolina State University, Box 8605, Raleigh, NC 27695-8605. For more information, call 919/515-2454.

— K.M.

Wild Horses Receive Birth Control Vaccine

This year, N.C. Division of Coastal Management officials are trying to stop the overpopulation of wild horses at the Rachel Carson reserve site in Beaufort.

In March, horses that live on a collection of islands that includes Carrot Island, Town Marsh, Bird Shoal and Horse Island received birth control vaccinations.

The division wants to control the number of horses to ensure that the herd continues to have enough food and water, and to prevent additional damage to the sanctuary, one of eight sites comprising the N.C. Coastal Reserve. Studies have shown that the horses severely damage important



Scott D. Taylor

plants on the reserve and increase erosion on the islands.

This is the third year the horses have been vaccinated. Because past vaccinations were unsuccessful, the horses received a new vaccine called

porcine zona pellucida.

The Assateague National Seashore near Ocean City, Md., famous for its wild horses, has used this vaccine for more than a decade.

Only mares received the vaccine, which is effective for one year. As older mares die, some younger horses will not receive vaccinations, allowing them to produce offspring and continue the herd.

— A. G.

Restoring Oysters

The nation's oyster stocks are under siege. Overharvesting and habitat destruction have hurt oyster populations all over the country, but diseases like MSX and Dermo are often the worst killers.

The U.S. Congress has funded an Oyster Disease Research Program to help determine causes and identify solutions to oyster disease. For a copy of the program's report, "Restoring Oysters to U.S. Coastal Waters," call Maryland Sea Grant at 301/405-6376.

While the country waits for a cure for oyster illnesses, North Carolina shellfish farmers arm themselves with new strategies to settle and grow more oysters on their leases. Fast-growing oysters also can be harvested before Dermo or MSX kills them. Neither disease is toxic to humans.

Several of the state's Fishery Resource Grant projects have been devoted to oyster research. Mark and Penny Hooper, operators of Hooper Family Seafood in

Smyrna, have received several mariculture grants to make the oyster fishery a profitable business once more.

In one project, the Hoopers experimented with the cage and rack method of oyster culture, an off-bottom system that promotes fast growth during the oysters' first 20 months. The cage and rack system is widely used on the West Coast and in France, but had not been tried with native North Carolina oysters.

The Hoopers found that using the system allowed faster oyster growth, with oysters reaching marketable size before diseases could kill them. Oysters produced in the cages were also very clean, giving the Hoopers a market niche.

Two other projects were designed to enhance methods of collecting wild oyster seed. Seed from wild stock gives oyster growers the advantage of growing hardy shellfish that are primed for the North Carolina environment.

— R.W.S.

Discover Ancient Fossils

Would you like to dig for prehistoric sharks' teeth and other marine fossils? How about exploring the PCS mine in Aurora — one of the world's largest phosphate facilities — or viewing an exhibit of prehistoric man in eastern North Carolina?

These activities are part of the 6th Annual Fossil Festival May 28-30 in Aurora. The festival, co-sponsored by the Aurora-Richland Township Chamber of Commerce and the town of Aurora, features a parade, fossil auction, street dance, vendors and singing groups.

Fossil collectors can add to their collections during digs May 29 and May 30 across the street from the Aurora Fossil Museum and at other locations. "In the past, people have found sharks' teeth, porpoise teeth, sea urchin spines and porpoise vertebrae," says Candace Holliday, the festival co-chairperson and the director of the fossil museum.

After digging for fossils, you can view a variety of museum exhibits, including fossilized bones, shells and coral, and discover how geologic forces have created this large bed of fossils.

If you miss the festival, but love fossils, don't despair. You can still visit the museum this summer. During June, July and August, museum hours are 9 a.m. to 4:30 p.m. Tuesday through Friday and 9 a.m. to 2 p.m. Saturday.

For more information, call 252/322-4238 or 252/322-4727 or visit the Web site: www.southfest.com.

— A.G.

Whispers from a Village: Portsmouth Legacy Lives On

By Julie Ann Powers

*Photographs by
Scott D. Taylor*

No one lives in Portsmouth anymore: no one to tell the story of how this pretty soundside village on North Core Banks came to be, no one to tell of all it has gained and lost since it was founded in 1753.

But the wind, rising along the sandy lanes, whispers of busy wharves and 18th century sailing ships. The distant surf murmurs of old-time fishermen filling their nets. A footfall on the Life Saving Station porch recalls brave men and daring rescues.

The church bell's chime, sounded by a tug on a rope, speaks of weekly respites to give thanks and gather strength. A creaky hinge on the post office door recounts when it was a portal to the entire outside world.

Continued



No one lives in Portsmouth anymore: no one to tell how changing ways and the fickle sea took away Portsmouth's purpose and its people, one by one.

Portsmouth, though, lives on — as a Cape Lookout National Seashore testimonial to an island lifestyle, gone forever. And Portsmouth lives on in the hearts of its exiled natives, who still cherish the cluster of sunwashed buildings, empty now for 28 years, as their hometown.

"When I say home, I mean Portsmouth," says Jessie Lee Babb Dominique. "I wish I could go back, every day." Now of Beaufort, she was the last baby born in Portsmouth, 71 years ago, the last scholar at its one-room school. Her sister and her aunt were the last two residents of Portsmouth, before isolation forced them off the island in 1971.



The village post office closed its doors in 1959.

In 1860, the population reached
a high of nearly 700 people,
including 117 slaves. The population
was only 320 in 1870.
A decade later, it had fallen to 220.

Dominique is among a handful of former residents who can remember Portsmouth, across Ocracoke Inlet from the village of Ocracoke, as a vibrant, small community.

In Dominique's childhood, families were close-knit and friends were always ready to help. The men served in the Coast Guard, as her father did, or fished for a living. Her hard-working elders relaxed on

summer evenings with a croquet match. She worshipped at the picturesque Methodist church on Sundays. She saw her neighbors on weekday afternoons in an island ritual that underscored Portsmouth's remoteness.

"We'd go and wait for the mail to come in," she says. "It came from the mainland in the afternoon. The general store was where people gathered."

The post office, established in 1840, occupied one corner of the general store and a prominent place in the far-flung village's daily life. Everything from letters to mail-order furniture to visitors arrived via the mailboat.

When Cape Lookout National Seashore was created in 1976 and took custody of Portsmouth, memories like these were deemed an important part of state and national heritage. The National Park Service keeps Portsmouth more or less as it was when occupied in the first half of the 20th century.

"Nothing much has changed," says Cape Lookout education specialist Laurie Heupel. "That's the point of Portsmouth."

On the National Register of Historic Places, Portsmouth today consists of about 20 structures and several cemeteries, scattered over about 250 acres at the northernmost tip of North Core Banks. The buildings and graveyards are located wherever high ground rises above the marsh. A mile of sand flats, sometimes underwater, separates the edge of the village and the Atlantic.

Though Portsmouth's history stretches back almost 250 years, most buildings date to the early 1900s. The houses last occupied are painted a light yellow. The Methodist church, considered the village symbol, was built around 1914; the schoolhouse in 1920. The turn-of-the-century Life Saving Service's barracks and watchtower, boathouse, summer kitchen and stables are at the rim of town nearest the ocean.

The oldest structure is thought to be the Washington Roberts house, dating to the late 1700s. Its massive wood foundation blocks were likely cut from timbers washed ashore from a shipwreck. Losses at sea sometimes were Portsmouth's gain, as islanders salvaged such cargo as coffee,

clothing and building supplies. The village also sheltered passengers and crew rescued from doomed vessels. Two sea captains who died in the early 1800s are buried on the beach side of the village.

Portsmouth once shared North Core Banks, also called Portsmouth Island, with two other nearby communities. Overgrown foundations and lost gravestones are all that remain of Middle Community and Sheep Island.

Accessible only by boat through treacherous waters, on an untamed, uninhabited barrier island, Portsmouth now is an easily overlooked nook of North Carolina. For the first century after its 1753 founding, however, Portsmouth was among the largest and most important Outer Banks settlements. Ocracoke Inlet was the only access through the island chain to the colonial ports of Bath, New Bern and Washington.

The ships of the day — traveling inbound with sugar and spices and fabric, laden with lumber and pitch outbound — drew more water than Ocracoke Inlet and

Pamlico Sound provided. Portsmouth and nearby Shell Castle Island evolved as a “lightering” station. Using slave labor, cargo was transferred to and from lighter, shallow draft boats for the journeys beyond.

Two-thirds of North Carolina’s exports in the early 1800s passed through Ocracoke Inlet. Traffic was heavy enough to merit a mariners’ hospital at Portsmouth to care for sick and injured seafarers. Its rainwater cistern — the sky is Portsmouth’s only source of fresh water — still remains. In 1860, the population reached a high of nearly 700 people, including 117 slaves, and the town boasted more than 100 buildings — homes, warehouses and stores.

The sea, though, already had begun to forsake Portsmouth. Ocracoke Inlet shifted and shoaled. Shell Castle Island, composed of oyster shells, eroded away. An 1846 storm sliced new inlets — and new trade routes — through Hatteras Island to the north.

Other events also conspired against Portsmouth. Railroads began to displace ships as a means of moving goods. The

approach of Northern troops during the Civil War in 1861 drove most residents off the island, and many never returned.

The population was 320 in 1870. A decade later, it had fallen to 220. With shipping commerce gone, fishing and shellfishing became economic mainstays for residents. Lodges to house those hunting the abundant waterfowl appeared in the early 1900s.

The post office, established in 1840,

occupied one corner of the general store

and a prominent place in the far-flung

village’s daily life. Everything from

letters to mail-order furniture to

visitors arrived via the mailboat.

The establishment of a U.S. Life Saving Service station in 1894 brought a new mission to the village. The rescue service, later incorporated into the present-day U.S. Coast Guard, recruited local men for its ranks, and was an important presence, philosophically and economically, for 43 years. The “surf soldiers” drilled rigorously for dangerous sea rescues, and the station commander was a community leader.

When the station was decommissioned in 1937, Portsmouth’s final spiral downward began. The station’s reactivation during World War II only forestalled the village’s demise. From the 1930 census

C o n t i n u e d



Portsmouth residents gathered for Sunday services to give thanks and gain strength.

of 104, the population fell to 17 in 1956. The post office locked its doors in 1959.

By 1970, just three residents — including Marian Gray Babb, Dominique's older sister, and Elma Dixon, Dominique's aunt — still called the island home, though they spent winters on the mainland. When the only man among the trio, Henry Pigott, died in January 1971, Dixon and Babb reluctantly moved to Beaufort. Dixon died in 1990, Babb in 1993.

The rescue service recruited local men

for its ranks. The "surf soldiers"

drilled rigorously for dangerous

sea rescues, and the station commander

was a community leader.

During their years on the mainland, both longed to be back in Portsmouth. They kept their Portsmouth houses ready to occupy, but returned to their island homes only to visit.

And the village of their younger years was frozen in time.

Recollections of Portsmouth's past have cast a spell reaching far beyond its former inhabitants. The last generation of residents has become nearly legendary through the oft-repeated accounts of their daily routines — Miss Annie Salter, the postmistress who wore her hair in a neat bun; Miss Mary Dixon, who taught for 37 years in the one-room school; Henry Pigott and his sister Lizzie, descendants of the slaves who toiled in the lightering business.

Henry Pigott, "A Friend To All," according to a tribute to him in the church,

was the island's last mailman. Like others before him, he piloted a skiff out to meet the Ocracoke-bound mailboat to pick up Portsmouth's letters and parcels. Lizzie Pigott grew lovely flowers and cut islanders' hair until a stroke confined her to a wheelchair.

Like many others, the park service's Heupel finds these vignettes of Portsmouth life irresistible.

"I've read so much about the village and the people, I think the people should be there when I go," Heupel says. "I'm looking for the lifesavers to be drilling. I'm looking for Henry to be getting the mail. I'm looking for the croquet matches to be going on in front of the post office."

Portsmouth attracts about 700 visitors a month in warm weather, a figure that has steadily risen over the past few years. Some of the increase is likely due to the growing popularity of Ocracoke as a vacation spot. A ferry service from Ocracoke is the only

practical means of transportation to Portsmouth for the majority of visitors.

Heupel thinks some visitors are seeking something besides an afternoon's distraction.

"Lately people are looking for a connection to the simpler times," she says. "This is one of the places to find it."

Portsmouth in pleasant weather does inspire wistful images of an uncomplicated existence. The quaint yellow houses look so cozy, the wide front porches are so inviting, the birdsong on a sweet, salt-scented breeze is so soothing. The church sanctuary is serene and still, a hymn book open on the organ's music stand.

Though Portsmouth life had its simple appeals, it also had hardships. Most means of livelihood — fishing, clamming, the rescue service — could be difficult and hazardous work.

As for housekeeping, the kerosene cooking stoves burned hot enough to dictate



The establishment of a U.S. Life Saving Service station in 1894 brought a new mission to the village.

summer kitchens that were separated from the main houses. Screened dairy houses were the only form of refrigeration. Electricity via generators came late to Portsmouth and only to a few homes. There were gardens and livestock to tend, clothes and fishing nets to make and mend, and weather to contend with.

Winter winds can be bitter and relentless. Hurricanes and nor'easters periodically flood the village. The ferocious storms are blamed for some of the exodus from Portsmouth. A 1913 hurricane destroyed the island's two churches.

The Methodist church, rebuilt the following year, was left leaning after a 1944 storm that also sent water swirling nearly a foot deep into Portsmouth living rooms. The church leans less since the park service recently straightened and stabilized the foundation.

Though Portsmouth life had its simple

appeals, it also had hardships.

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fishing, clamming, the rescue service —

could be difficult and hazardous work.

Though less dramatic than hurricanes, the daily assault of salt air, sun and wind takes a heavy toll on the aging buildings. Portsmouth's main ally in the battle against decay is Dave Frum, who spends three days a week in Portsmouth as maintenance man for Cape Lookout National Seashore.

"I'll never work myself out of a job," he says cheerfully. He is perhaps the epitome of job satisfaction. He fell



Dave Frum spends three days each week maintaining Portsmouth's aging buildings.

instantly in love with Portsmouth on his first visit long before he went to work there eight years ago. Every day he spends intensifies his affection.

"This is the prettiest place in the world," he says. "Every day is an adventure."

He patrols the lanes in an all-terrain vehicle, tools at hand. He stops to hammer a board on the side of the church, where nails have crumbled to rust. "This is historic preservation," he says.

On another front, he combats fast-growing vegetation, kept at bay by roaming livestock in Portsmouth's earlier days. Frum recently has cleared much underbrush, restoring the view that islanders once enjoyed. The clearing also reduces the scourge of mosquitoes long synonymous with Portsmouth. Every island stoop used to bristle in summer with leafy switches to brush away the bugs.

Frum commutes a half-hour by boat from Ocracoke every Monday, Tuesday and Wednesday. Winter on the water is sometimes so harsh it mandates survival gear. He doesn't mind.

"When I leave on Wednesday," he says, "I can't wait until I come back on Monday."

He ponders for a moment why Portsmouth has such a pull on him, and on others. "I have the feeling there's the spirit of 200 years here," he finally says. "It feels so calm in a busy world."

Cape Lookout National Seashore enlists help from other quarters in keeping the structures intact. Several homes are leased to individuals to use as vacation retreats. Besides a few thousand dollars per year in rent, the long-term agreements require leaseholders to maintain and improve the buildings.

The Friends of Portsmouth Island also works with the park service to preserve village buildings. The group plans to restore the church windows. The park service recently rehabilitated the exterior of the post office; the friends group will refurbish the interior.

The Friends of Portsmouth Island coalesced about a decade ago, says current president Chester Lynn of Ocracoke.

C o n t i n u e d

Membership is estimated at 300. Several of Portsmouth's former residents belong. Other members, like Lynn, are kin to Portsmouth families. The remainder have no connection except a

fondness for the place and a fascination with the way life was.

"A lot of people love the area, love the history," he says. Lynn recalls many childhood trips to Portsmouth. His grandfather was part owner of a mailboat that served Ocracoke and Portsmouth. His great-grandmother, Helen Dixon, was born on Portsmouth. Her Dec. 23, 1889, marriage to James Fulcher of Ocracoke is recorded in the family Bible. "Eight boats returned to Ocracoke, tied together in a wedding chain," Lynn reads from the entry.

Lynn spends his spare time searching for cemeteries and individual gravestones he suspects are still hidden in the thick underbrush.

"The history on those tombstones is priceless," he says.

Besides helping with preservation of the physical Portsmouth, the group aims to sustain the essence of the village by recording the stories of former residents. It hosts a meeting every spring and fall on Ocracoke, and a homecoming on Portsmouth every other year.

Though it has no permanent residents, Portsmouth is occupied by at least one person during the warmer seasons, also intent on preservation. In exchange for a firm commitment of three months of repair and maintenance work, unpaid caretakers get shelter in the lifesaving station's former summer kitchen — and an incomparable experience, at least for those who savor solitude and seclusion. Such solitude, tinged with a certain loneliness, is the



Like these sea captains' gravestones, Portsmouth is a testimonial to generations past.

The church bell's chime,
sounded by a tug on a rope, speaks of
weekly respites to give thanks and
gather strength. A creaky hinge
on the post office door recounts when it
was a portal to the entire outside world.

shadow of Portsmouth's past personality, an atmosphere that still cloaks the island.

Richard Meissner, a retired English teacher from Asheboro, spent a spring of constant captivation at Portsmouth. He recalls a day when he was to meet Frum at the park service dock.

"I went out to the pier to wait for him. I took a book because I didn't know just when he'd be there. I got fascinated with some oyster catchers there by the dock. I don't know how long I waited for him. Thirty minutes? Two hours? I don't have a clue," Meissner says. "I never read a word of my book. That's how it is. There's

always something to do. There are birds. There are sunsets. There are stars to look at."

The present-day Portsmouth is both sweet and sad to people like Jessie Lee

Babb Dominique, who remember when friends and family made the silent buildings a community. Though it brings tears to her eyes, she comes to visit as often as she can manage the trip. Much of the journey, as in the past, is by boat.

At other times, at her house in Beaufort, she is surrounded by reminders of Portsmouth people held dear — her great aunt's mail-order rocking chair, her mother's sewing machine, a vase that belonged to her friend Miss Hub — and memories of Portsmouth.

"There's never a day that I don't think of home," she says. "It was home, and it is home and it will always be home." ■

Portsmouth Village is accessible only by boat. Contact Cape Lookout National Seashore, headquartered in Harkers Island, for information on park service concessions that provide ferry services from Ocracoke, or kayak and all-terrain vehicle expeditions. Phone: 252/728-2250. The transportation services charge a fee, but there is no charge to visit Portsmouth.

The Methodist church, a visitors' center in the Dixon-Salter house and the Life Saving Station are the only buildings presently open to the public. The only facilities in Portsmouth are solar toilets. Visitors should dress for the elements, wear sturdy walking shoes, and bring drinking water and other provisions. Sunscreen and insect repellent are also recommended in warm weather.

When Jessie Lee Babb Dominique was born Aug. 2, 1927, Portsmouth was still a going concern of about 100 people. But its future was cast. She was the last baby born in the village.

In her childhood Portsmouth, family and friends were close. Her mother, Lillian Dixon Babb, had two sisters and a brother who lived together down the lane. Her father, Jesse Babb, was in the Coast Guard.

"I spent a lot of time with older people," Dominique recalls. "I would get up in the morning and say, 'I think I'll go spend the day with Miss Hub.'" Miss Hub was Annie Hubbard Styron, who with her husband, Jody Styron, and her brother, Tom Bragg, operated a hunting lodge. Tom Bragg taught her to fish and tell time, Dominique recalls. When she was a little older, Dominique helped in the kitchen, preparing supper for the sportsmen.

The Babb home was among the first to have electricity, furnished by a generator. Jesse Babb also wired the nearby Methodist church for generator electric lights.

Once a month, a minister from Ocracoke came by mailboat to preach, staying over the weekend because of the boat schedule. "We'd have him for three days," Dominique says. In between, islanders held their own Sunday school.

She remembers weekday gatherings at the post office, awaiting the mail. Portsmouth relied on mail-order for everything residents couldn't make, grow or catch, and the mailboat was the primary means of transportation to and from the mainland.

In earlier times, the boat, which also served Ocracoke, tied up at a fish factory dock on Casey's Island just off Portsmouth, and the goods were ferried ashore. After the dock deteriorated, Portsmouth's letters and parcels and travelers were transferred to the mailman's skiff in mid-channel.

Memories of Home from Portsmouth's Last Baby

By Julie Ann Powers



Portsmouth is still home for Jessie Lee Babb Dominique.

Henry Pigott was the last mailman. Henry and his sister, Lizzie, were the only blacks on the island, descendants of the slaves who worked in the early Portsmouth's shipping industry. Lizzie Pigott was known for cutting hair and growing flowers.

"I loved them dearly," Dominique says, and recalls many days at Lizzie's side as a child.

"After supper she would take a bath and put on a freshly starched and ironed

dress — those were the old hand irons, heated on the stove," Dominique remembers. "And she would smell so good. She would walk down to our house, and they would play croquet."

The one-room school, built in the 1920s, once had an enrollment of 45. But Dominique was among just three who attended the last term in 1943. Her classmates, children of Coast Guardsmen stationed on the island during World War II, moved away that summer, and the school closed. Her parents didn't want to send their youngest daughter to Ocracoke, so Dominique forewent the last year of high school.

Two years later, she left Portsmouth — for New York City. Her oldest sister Edna had married a Coast Guardsman from New York, and the young family went to the big city when his service in Portsmouth was over. To keep her sister company in the new surroundings, the teen-aged Dominique traveled alone by boat and bus and train to New York. She stayed two years, working in a pocketbook factory and later as a bookkeeper for Talon Zipper Co.

Meanwhile, her parents moved to Beaufort. Dominique went to work in a Morehead City restaurant when she returned to North Carolina, where she met her future husband, Robert Dominique, a Coast Guardsman, in 1948.

Her mother later returned to live in Portsmouth, and is buried on the island. Dominique's other sister, Marian Gray Babb, also returned to Portsmouth. Babb, who died in 1993, and her aunt Elma Dixon, who died in 1990, were the last residents of Portsmouth. Their reluctant departure from the island in 1971 was the end of an era.

But not, Dominique and other former residents insist, the end of Portsmouth, which persists in spirit among those who lived there and love it still.

"We won't let it die," she says. ■

IS WATER-USE
CROWDED
PLANNING IN
COASTAL
NORTH CAROLINA'S
WATERS
FUTURE?

By Renée Wolcott Shannon

Photos by Scott D. Taylor



Imagine this: You buy a house in a quiet residential neighborhood of a large city, with nice lawns and big trees. One day someone buys the vacant lot next door, and pretty soon the new owner digs up all the wildflowers and puts in a racetrack. Or a chemical factory. Or a disco.

This is unlikely to happen, of course. And if it did, you'd probably have plenty of legal recourse against your annoying new neighbor. In cities and towns, land-use planning and zoning laws mitigate conflicts between residents and businesses, and they help keep go-cart tracks, factories and discos separate from private homes.

Now imagine this: You buy a beautiful house looking out over a quiet coastal river. Soon you've got noisy boats zooming past your house all day long.

What can you do? In many cases, the answer is "nothing."

Land-use planning arose in the United States in the 1920s, as an increasing population and limited land area forced people to search for ways to allow multiple uses for land while keeping conflicts over noise and pollution to a minimum. Now, as society becomes more and more complex, zoning and planning confine land uses to different areas, so potentially disruptive activities won't disturb others' enjoyment of private property.

As recreational and commercial uses of public waters skyrocket, there is no similar strategy for preventing conflict. Water skiers, shellfish-lease owners, fishers and waders jostle one another for space in North Carolina's creeks and sounds. As a result, boating accidents, complaints from waterside residents, disturbance of animals and their habitat, degradation of water quality and boat wake-induced erosion are on the rise. Is water-use planning and zoning an answer?

Yes, says North Carolina Sea Grant legal and policy specialist Walter Clark. But North Carolina is a long way from the kind of comprehensive water-use planning that he envisions. "So far, we're Band-Aiding specific problems as they arise," Clark says.

Noisy Nuisances and Crowded Creeks

Personal watercraft (PWC) and other noisy recreational boats are among the most prolific causes of water-use conflicts in North Carolina, and often prompt a municipality's first attempts at zoning. In Nags Head, the town petitioned the state for extra-territorial jurisdiction extending

The people out there are more comfortable."

Nags Head has also banned air boats, which can be heard miles from where they are being operated. "They were our biggest area of complaint," says Bortz.

With a grant from the N.C. Division of Coastal Management, Nags Head is now processing data from a 1998 survey



Though North Carolina lacks a comprehensive water-use zoning strategy, it does designate no-wake zones and areas that are closed to shellfishing.

one mile into Roanoke Sound. The town now zones in two areas divided by the Nags Head causeway. "If it can be zoned, we zone it," says Bruce Bortz, the Nags Head town planner.

Recently, the town passed a local ordinance banning commercial rental PWC from coming within 600 feet of shore and limiting local businesses to renting eight PWC at a time. For the 1998 summer season, the ordinance meant that only 56 PWC could be on the water at once, down from 229 total units available in 1997.

"Practically speaking, the establishments could only rent 10 to 12 units per hour (before)," says Bortz. But with fewer rentals and the 600-foot buffer between PWC and the shore, "It's less hectic now.

designed to determine the recreational "carrying capacity" of Nags Head waters. Like many coastal communities, Nags Head depends on tourism and on water-based activities for a thriving economy. Overcrowding and conflict in nearby waters could drive tourists away and hurt the town's businesses.

The survey used a questionnaire developed by a private consulting firm to explore vacationers' attitudes toward the numbers of PWC, power boats, sailboards, kayaks, swimmers and fishers in area waters. Most people interviewed were vacationing in Nags Head, and few found the waters too crowded to be enjoyable. The results suggest that the current limit on PWC rentals is appropriate. Bortz says that

Continued



With personal watercraft, powerboats and sailboards in the water at once, boating safety becomes a top priority.

the Nags Head Board of Commissioners will also review the consultants' recommendations.

Another focus of contention in coastal municipalities has been the increasing number of free-standing moorings. Boats that moor in narrow creeks can prevent local residents from enjoying a view of the open water, interfere with navigation and impede riparian access — the right of shoreline property owners to reach deep water from land.

Jane Daughtridge, district planner with the Division of Coastal Management in Washington, says that marinas sometimes try to increase their commercial capacity by adding free-standing moorings in the public trust areas. Other conflicts may arise when transient boaters attempt to place permanent moorings in unauthorized areas or when residential property owners attempt to use their riparian water rights for supplemental income by renting out their moorings to others.

In 1995, the N.C. Coastal Resources Commission (CRC) adopted a Coastal Area Management Act (CAMA) regulation limiting free-standing moorings in the 20 coastal counties: Boat owners may moor only in front of their own shoreline property, or in mooring fields that have been sited by the local government. Several cities in the Washington district have since passed additional ordinances to ban free-standing moorings altogether. In Bath and Belhaven, town officials have used their jurisdiction over inland waters to pass such bans. They also prevent transient

boaters from anchoring in their waters for more than seven days.

Bath trailblazed this kind of local zoning for moorings, says Marty Fulton, town clerk. The town's zoning jurisdiction includes the water to the mouth of Bath Creek. "A number of other local governments have called to see how we did it," she continues. They want to replicate the language of the ordinance.

The ordinance helps the small town foster its historical image, Daughtridge says. The ban keeps Bath's harbor picturesque and uncluttered.

Other municipalities depend on high-volume water traffic and a welcoming harbor for transient boaters. If cities want to allow boats to continue to moor, they can designate a mooring site and petition the state for a mooring field permit. To date, this is the only case in which the state requires a water-use plan before granting a request.

Beaufort is the first town to receive such a permit, and the process took two and a half years to complete. "Sailboats anchoring in front of Beaufort are a big tourist attraction," says John Young, director of public works for the town of Beaufort. "People come out here just to look at the boats." The new mooring field will allow Beaufort to maintain the fleet of boats regularly anchoring in Taylor Creek and prevent the demise of a long-standing attraction for out-of-town visitors.

In July, the town hopes to begin installing the mooring field, which will provide 66 temporary and permanent

moorings for boats up to 45 feet long. "It will be a municipal mooring field," Young says. Beaufort police will keep track of resident vessels and make sure boat owners follow regulations.

The city's water-use plan, which was developed as part of the permit application, includes a lock-head policy to prevent boats from dumping sewage, an environmental-impact assessment and a description of the shore facilities available to boat owners, such as pump-out facilities, showers, trash containers and oil-recycling facilities.

Clark, Sea Grant's policy specialist, was pleased to learn of the breadth of the plan. "The intent of the regulation was to encourage local governments to think about where moorings would cause the least disruption of other uses without banning moorings altogether." He sees this type of planning as a harbinger of things to come. "If different uses are going to coexist in crowded waters, then it will be a necessity."

A Model Plan for North Carolina

For water-use planning to succeed, Clark believes the state will need to work closely with local governments in setting broad but flexible guidelines for the CAMA counties. The state will also need to provide funding to help local governments with their increased planning responsibility. "Right now we don't have grant money to give counties to undertake large-scale planning," Clark says.

But in 1990, the Albemarle-Pamlico Estuarine Study (APES), which is underwritten by the U.S. Environmental Protection Agency, solicited proposals to examine management options for water use. Clark received funding to develop a model water-use plan for Carteret County, a fast-growing coastal county blessed with a rich abundance of natural resources.

Carteret County citizens were extremely interested and involved in the plan from the beginning, Clark says. The county planner worked closely with Clark, and he consulted an advisory board made up of Carteret County regulators and water users. But when the plan was complete, Clark says, "they weren't ready to imple-

ment it. The need for it wasn't there yet; it was too early." If conflicts then had been as heavy as they are now, he continues, the story might be different.

Like other counties subject to CAMA, Carteret is required to develop its own land-use plans based on general state guidelines. But CAMA does not mandate formal water-use planning, even though the state emphasizes the importance of managing water areas in preserving coastal resources.

Clark's model plan proposed a water-use planning structure that followed the pattern of existing land-use planning practices. First, Clark examined local, state and federal laws, regulations and ordinances that applied to the county's estuarine waters and shoreline. Then, using Geographic Information System (GIS) technology, Clark classified the county's waters and suggested regulations for their use that would not conflict with pre-existing laws.

The planning strategy differed from the land-use planning model in one significant way. "Public waters are state-owned," he explains, while land is usually under private ownership. Technically, the state owns most of North Carolina's coastal creeks, rivers, estuaries and sounds — and the ocean waters to a distance of three miles offshore — and holds them in trust for the public. The state has the responsibility to act as steward for these waters and to regulate their use, but it can pass some of that authority to local governments.

Right now the CRC requires land-use plans for North Carolina's 20 coastal counties, but the plans have historically stopped at the water's edge, ignoring the large aquatic areas included within many counties' jurisdictional boundaries. Clark suggests that the planning process be extended to cover the water as well.

Combined plans like these would require counties and municipalities to think about appropriate uses for water and would mean increased cooperation between land and water activities. Regulations could affect the siting of new marinas or public boat ramps, and could work with habitat

management plans to protect environments critical for juvenile fish or crabs. Proactive plans that take into account both water-based and shoreline activities could help predict and prevent future water-use conflicts.

In the model plan for Carteret County, for example, Clark surveyed existing water resources and uses — like beds of submerged aquatic vegetation, navigation channels, recreational and commercial fishing areas, and high-population shorelines — in order to classify water areas. The North Carolina Center for Geographic Information and Analysis digitized the data from the survey as a series of "layers" that could be mapped and overlapped to provide intersections between various water uses.

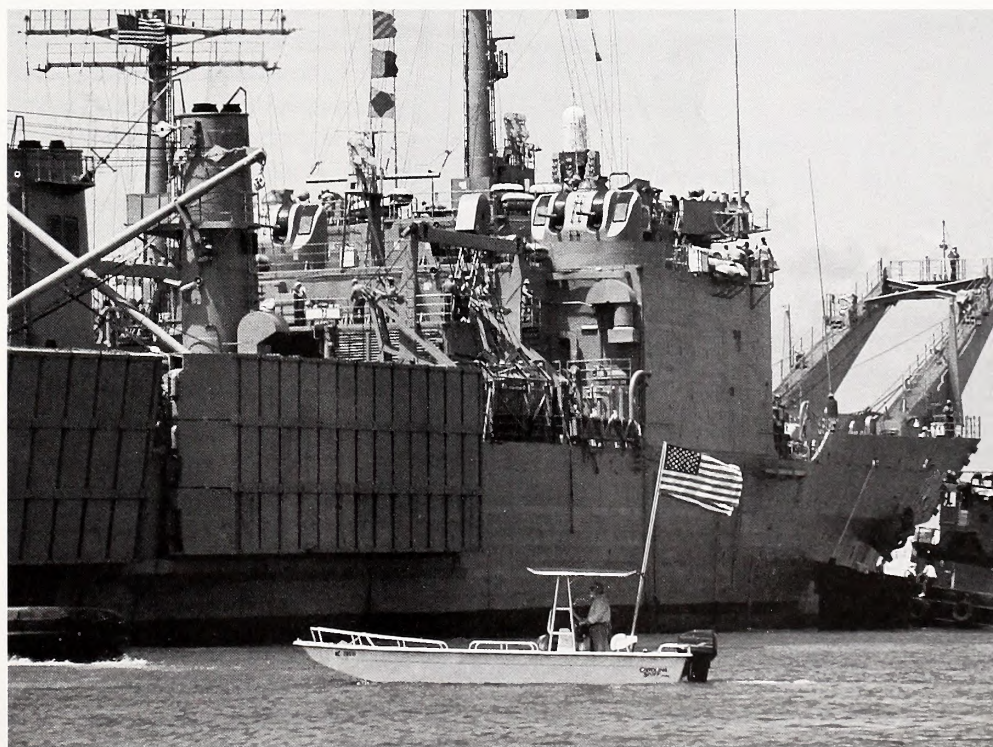
By using GIS to view all the layers at once, Clark could determine which areas of Carteret County were already heavily developed and which needed special protection because of environmental importance. Classifying and mapping specific water areas in this way would assist

local governments in designating areas for certain policies to apply. Advisory boards and public hearings would help local governments determine their individual water-use goals and to develop policies mandating those goals. But without leadership from the state, it's hard for local governments to formulate wide-reaching water-use plans, Clark says.

Daughtridge, with the DCM, agrees to some extent: "Most local governments don't have the resources or GIS capacity to do in-depth analyses." But, she adds, there is funding available for certain water-use projects.

"CAMA does have a beach and waterfront access grant program to help local governments acquire or develop waterfront properties to get the pedestrian public to the water," Daughtridge says. Local governments could also use CAMA's planning and management grants to develop detailed water-management plans if they chose. Grant offerings are sent to local governments in early spring.

Continued



Boats of all sizes pass through North Carolina's waters; a new CAMA regulation dictates where they may anchor.

Strategies in Other States

The water-use plan Clark outlined for Carteret County was designed to fit into North Carolina's existing legal structure, but other states have handled conflicts in their waters differently. "We have a more regulatory way of dealing with things," Clark says. "In Virginia, they're taking a more educational, proactive approach."

"We have to focus on education," says Hugo Valverde, environmental planner for the Hampton Roads Planning District Commission and graduate of Duke University's Coastal Environmental Management Program. "Virginia is a 'Dillon Rule' state, which means that a locality only has powers that are expressly

given to it by statutes from the state. We can't ban Jet Skis." North Carolina is also a Dillon Rule state, but its General Assembly traditionally has granted local governments more freedom.

"Right now we're looking at the North Landing River, which drains from Virginia Beach into the Currituck Sound of North Carolina," says Valverde. The commission hopes to get groups of water users and regulators — including state and local boating agencies, the Nature Conservancy, wildlife refuge managers, the Coast Guard and the U.S. Army Corps of Engineers — to look at conflicts between users and to come up with a memorandum of agreement that provides guidelines or visions for

participants to follow. But instead of regulating the water uses, Virginia municipalities will have to rely on improving their educational programs.

"Many people just don't know the boating safety rules or the environmental impacts of what they do on the water," says Valverde. "For boating education and boating safety classes, we'd like to add a section on environmental impacts of boating." Such revised courses might teach boaters how to recognize and avoid environmentally sensitive areas, in addition to clarifying boating regulations, no-wake zones and noise laws.

Educational programs for PWC drivers are already in the works. "In Virginia Beach, the Virginia Marine Science Museum is working on a Jet Ski education program about sea turtles and dolphins" so people will know not to approach or harass the animals, Valverde says. "There's a breeding area for dolphins off Virginia Beach."

And Virginia can pass water-zoning laws — they just have to come from the state level. In response to several PWC-related accidents, lawmakers from Virginia Beach

have recently initiated legislation that allows localities to limit the horsepower of PWC offered for rent, says Valverde.

Last year, the Virginia General Assembly also passed laws that allowed localities to establish minimum standards for insurance carried by PWC rental agencies, raised the minimum PWC operator age from 14 to 16 and required those who are in the business of renting PWC to pass a boating safety course. PWC rental agencies are also required to instruct renters on safe boating practices.

Virginia is one of only a few Dillon Rule states; many other states, including those on the West Coast, place a greater emphasis on regulation as a way to reduce conflict and protect and maintain their coastal waters. In Washington, one of the states Clark turned to for guidance in developing his model water-use plan, the Shoreline Management Act (SMA) covers all the state's major waters, shores and wetlands and establishes broad guidelines for local governments to follow in developing their own shoreline master programs.

Washington's SMA gives preference to coastline and water uses that protect water quality and the natural environment, depend on proximity to the water, and preserve public access to the water or increase public recreational opportunities along the coast. Local governments' shoreline master programs are based on these guidelines but may be tailored for the particular geography, economy and environment of each city or county. Local municipalities regulate water uses, but the state reviews local programs and makes permit decisions.

Local jurisdictions that want to improve their shoreline master programs or increase public access may also apply for money from Washington's Coastal Zone Management grant program. Funds are administered by the National Oceanic and Atmospheric Administration and by the state's Department of Ecology. In the past, grant monies have been used to revitalize crumbling waterfronts, collect data on critical wetland and estuarine habitats, and sponsor educational programs about coastal systems or shoreline management regulations.



In a recent study, Michael Orbach, right, surveyed shellfish-lease owners and fishers to identify traditional water uses and to help classify water areas for possible zoning.

Different water areas are much more likely to be recognized and zoned in Washington's water-use strategy. Under the Washington state constitution, harbor areas are to be delineated and reserved for navigation and commerce. The planning department for the city of Bainbridge Island recently implemented a harbor management plan that encompasses the island's four major harbors, listing objectives for each harbor and specific policies to meet those objectives. And in San Juan County, comprised of 400 islands and the surrounding 440 square miles of marine waters, the local government has just become the first in the country to ban the use of PWC altogether, except for through traffic and emergencies.

North Carolina's Future

Today, North Carolina's plans for reducing conflict in our waters include neither an educational strategy like Virginia's nor a planning scheme as complex and powerful as Washington's. The level of conflict doesn't warrant a comprehensive plan at this point, says Clark, but the conflicts are intensifying. Landowners along the shore want riparian access to deeper waters and the right to build docks and piers, which can interfere with the public's desire to use the same water for water-skiing or fishing. Shellfish leases granted by the state compete with recreational and commercial fishers who gather clams and oysters from wild beds.

Right now, the state has an opportunity to think ahead on the issue of water-use planning. Michael Orbach, the director of Duke University Marine Laboratory, has teamed up with the N.C. Division of Marine Fisheries (DMF) to map the human uses of Core Sound, a site of particular contention between shellfish lease owners and other fishers.

Though the state owns the public trust waters and the lands lying underneath them, it leases bottom plots to individuals who want to culture shellfish there. In recent years, the shellfish lease program has been expanded to include the water column above the shellfish bed, so that aquaculturists can use more profitable off-bottom



Crowded shores like this one call attention to the multiple uses of our coastal waters.

racks and cages for growing clams or oysters.

"This is controversial because the state is granting exclusive rights to public trust property," says Orbach. "Wild shellfish gatherers feel that shellfish leases compete with them for space, markets and prices."

Two years ago, the conflict over shellfish leases in Core Sound became so hostile that the state legislature put a moratorium on new leases in the area. That moratorium has now been extended to July 1 and may be extended for yet another year.

While the DMF decided to map the shellfish resources in Core Sound in an effort to find solutions to the problem, Orbach thought the conflict represented a human-use conflict more than a conflict over resources. He applied for a grant from the division to expand their project to include a map of human uses of Core Sound. From the results of the mapping projects, Orbach hopes to develop a user-coordination plan for the sound that would prevent conflict between various user groups.

In many ways, Orbach's study mirrors Clark's plan for Carteret County: "Walter's project provided some of the ideas that spawned this project," says Orbach. Researchers have surveyed the historical and contemporary uses of Core Sound, and last summer they surveyed recreational and commercial fishers on their uses of the water and their attitudes toward other users. The resulting data is being plotted into GIS maps for comparison with the data from DMF's Shellfish Mapping Program.

"Right now, Fisheries is finishing with their part on shellfish resources," Orbach says. He hopes the project will be com-

pleted by late June, when the DMF will present a final report to the N.C. General Assembly. It will be up to the state to decide how to act on the report; its decision could mark a major first step in North Carolina's development of water-use planning strategy.

"Currently, there's an indefinite moratorium (on new shellfish leases) on the east side of the sound and a temporary moratorium on the west side," Orbach says. "The legislature could take the whole moratorium off ..., put a cap on the percentage of the bottom available for leases, restrict leases to certain locations or kick the issue back to the Division of Marine Fisheries to develop rules for shellfish leases under specific guidelines." Such guidelines might include promoting aquaculture, protecting commercial and recreational fish harvests, and preventing conflict between users.

Traditionally, North Carolinians haven't seen the water as something that needs to be zoned. The state's waters are plentiful and bountiful; it's hard to imagine a time when the water will be too crowded, noisy or polluted to enjoy. Still, that time may be fast approaching. Thousands more visitors flock to North Carolina's shores every year, and increased tourism means more people sunning on our beaches, swimming in our sounds and boating in our ocean waters.

"We have so much in North Carolina: our sounds, our coastal rivers," says Clark. "Until recently, we didn't have a lot of people using them. Basic rules and regulations used to be enough to keep people from bumping into each other. But now we need structure." ■

Hatteras History on the Move:

Lighthouse Relocation in Progress

By Katie

Mosher

Photographs

by Michael

Halminski



Since 1870, the Cape Hatteras lighthouse has been a symbol of the North Carolina coast.

Its candy-cane stripes inspire countless painters, poets and trinket-makers. The lighthouse also inspires a fierce debate on erosion-control efforts.

Proposals to move the lighthouse arose at least a decade ago, in an effort to save it from the encroaching sea. Earlier this year, despite a continuing court battle, the moving process began.

The keepers' quarters were the first to be lifted and trucked to the new site, nearly 3,000 feet to the southwest. In early March, the beacon was shut off as workers from International Chimney Company of Buffalo, N.Y., began separating the tower from its foundation.

Dare County officials, along with the Save the Cape Hatteras Lighthouse Committee, lost their court challenge to the relocation. The National Park Service expects to have the 4,800-ton tower lifted onto dollies in May. The slow roll to the new site — the culmination of the \$12 million project — is expected in June and July.

When first built, the Hatteras light stood 1,500 feet from the sea. By the 1930s, steel groins and barrier sand dunes were added to protect the lighthouse from the ocean water only 100 feet from the foundation.

The lighthouse was transferred from the U.S. Coast Guard to the National Park Service in 1936 as its days as a ship-saver seemed doomed. The Coast Guard reactivated the beacon in 1950 as the beach area stabilized through combined efforts of man and nature.

But the erosion-control efforts were far from over. By the 1970s, various strategies were employed to protect the lighthouse, including sand-filled nylon bags, beach renourishment and three concrete groins.

Continued

TOP:
The principal

keepers'

quarters

move to a

new site.

MIDDLE:

Extensive

foundation

preparation

is required

before the

move.

BOTTOM:

A diamond

cutting saw,

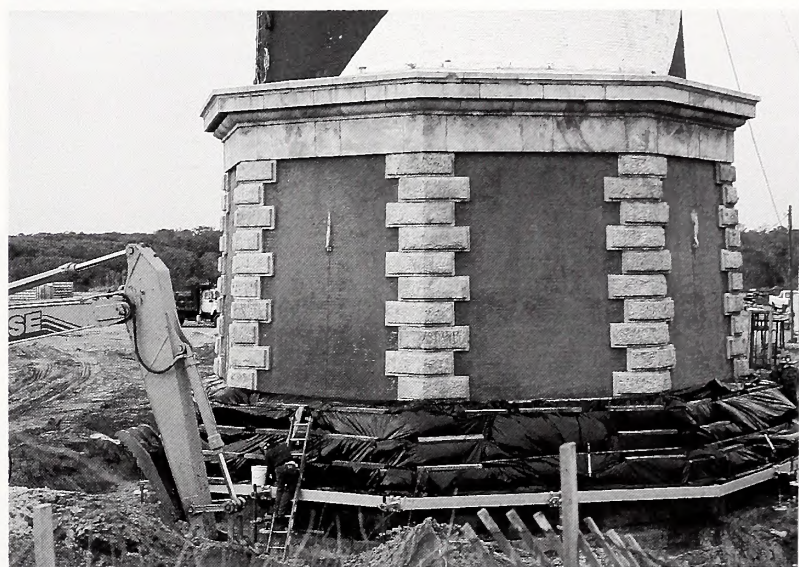
lubricated

with water,

extends

around the

foundation.





TOP:

Site manager

Skellie Hunt

surveys the

foundation

work.

MIDDLE:

Braces support

the lighthouse

prior to the

move.

BOTTOM:

This aerial,

looking south,

shows the

current

lighthouse

location and

the move

corridor to the

new site,

nearly 3,000

feet to the

southwest.

The 1980s were marked by damaging storms and a controversial report by the National Academy of Sciences recommending that the lighthouse be moved. The debate continued through the 1990s.

Congress eventually approved funds for the relocation, which is attracting worldwide attention. The park service expects the lighthouse will reopen for public use by Memorial Day 2000.

But moving the lighthouse will not quell the debate on erosion control for the Hatteras Island beaches, according to Spencer Rogers, North Carolina Sea Grant coastal engineering specialist.

"The issue of maintaining a groin field will not go away," Rogers says.

Some people believe the groins — walls built into the sea perpendicular to the beach, in an effort to trap sand and stall erosion — have protected homes and businesses in Buxton.

The park service does not plan to maintain the groins. If a hurricane or nor'easter pummels the structures, damaging them more than 50 percent, residents and county officials could be sent scrambling. State regulations do not allow for new construction or replacement of hardened structures on the oceanfront.

"The guidelines are pretty clear," says Steve Benton of the N.C. Division of Coastal Management.

Exceptions have been made to protect historical structures, such as Fort Fisher and the Hatteras lighthouse. But if the Hatteras landmark is no longer vulnerable, the issue will be placed in a new light. ▣

For more information on the Cape Hatteras lighthouse relocation schedule, call the National Park Service visitors' center at 252/995-4474 or check the park's Web site at www.nps.gov/cahal/lrp.htm.

North Carolina Estuarium

Showcases Sights and Sounds of an Ecosystem

By Ann Green • Photographs by Scott D. Taylor

As motorists rush across eastern North Carolina to the barrier island beaches, they often forget about the magic and mystique of swamps, rivers and sounds.

Along the dark, winding Tar River, frogs croak on the muddy banks. Further down on the brackish Pamlico River, osprey whistle over the thick, tall rushes. Undereath

the shallow waters of the Pamlico Sound, speckled trout chatter and purr when calling for mates.

The bountiful marine life and plants are part of the vast ecosystem of the Albemarle-Pamlico estuarine system, which includes the Albemarle and Pamlico sounds and the surrounding waterways and tributaries. The system stretches over 2.2 million acres of water, making it the second largest estuarine system in the United States after the Chesapeake Bay. More than 90 percent of the seafood caught by North Carolina fishers spends at least part of its life in estuaries.

The North Carolina Estuarium showcases the sights and sounds of the



The North Carolina Estuarium offers a glimpse into a unique region.

ecosystem and demonstrates how human life impacts the system.

Located in downtown Washington on a picturesque site overlooking the Pamlico River, the 12,500-square-foot facility opened in January 1998. It is the first aquarium in North Carolina to focus exclusively on the state's estuaries. The only other estuarium in the United States is at the Dauphin Island Sea Laboratory near Mobile, Ala.

The North Carolina facility is operated by the Partnership for the Sounds, a nonprofit group striving to build a prosperous economic base for the Albemarle-Pamlico region by promoting ecotourism and environmental education.

To encourage the protection of North Carolina's estuarine system, the building is packed with a variety of educational experiences, from films to interactive exhibits.

"The environment and health of the environment is important to the quality of life and public health in North Carolina," says Jackie Peoples

Woolard, director of the Partnership for the Sounds in Columbia. "When we bring school kids into the estuarium, we are planting a seed for a more healthy environment and more environmentally responsible citizens. It's investing in the future of North Carolina to take care of our environment."

To stimulate interest in the state's estuary system, an interactive wire and driftwood sculpture dominates the lobby. Designed by Washington native Whiting Toler, the "Water Droplet Pinball" sculpture shows the water cycle from North Carolina's mountains to the piedmont and down to the coastal sounds.

Continued

PEOPLE & PLACES



An old wooden "sinkbox" showcases a bygone era.

After a guide pulls a launching device, a pinball action shoots a ball through a funnel cloud onto a track where it starts the evaporation process. The water condenses and forms raindrops as it heads over land, represented by driftwood collected from the coast after hurricanes. The rain water continues through the mountains and the Piedmont, then into the coastal river where it mixes with salt water to form estuaries. The cycle ends in the ocean.

"The whole process is Mother Nature's way of recycling water," says Randy Rouse, exhibits curator at the estuary. "It is a whole purification process of water being reused. The flow of water is important to the well-being of aquatic life in the whole system."

Near the lobby is a 60-seat auditorium where you can watch a 15-minute film with breathtaking scenery — from waterfowl flying over a dark river to a sunset sail on a sound. You can also listen to the rush of water, the roar of a thunderstorm and Red Clay Rambler Bland Simpson singing "Home on the River." The film whets your appetite for a boating adventure through an estuary.

"We are trying to give people an emotional sense of an estuary," says

industry. We want North Carolina's estuary system to be appreciated and preserved."

After seeing the film, you can participate in a variety of interactive exhibits showcasing the Tar-Pamlico Watershed, Pamlico River and Pamlico Sound. By touching a button, you can hear a seagull laughing or shrimp snapping like frying bacon. You can also feel a sharp model of sedges, rushes and grasses. To show that estuaries are formed when fresh and salt water mix, visitors can taste concentrations of salt water from the ocean, brackish water from estuaries and fresh water from inland rivers.

Wander farther back and view live critters in their natural habitats. One aquarium holds blue crabs. The other houses tiny flounder disguised so well in sand that it takes a sharp eye to find them.

You also can view numerous artifacts and photos, including ballast bottles and binoculars from shipwrecks off the North Carolina coast.

The oldest artifact is a dugout canoe remnant that dates back 2,400 years. The canoe, used by Native Americans, was

Blount Rumley, estuarium facilities administrator. "Many people have driven by and sailed through estuaries with no real understanding of its impact on people's lives and the maritime and seafood

discovered on the bottom of Lake Phelps in Pettigrew State Park in the mid-1980s.

Keep exploring and you find another treasured artifact — an old wooden "sinkbox" once used by duck hunters in eastern North Carolina. The deck of the sinkbox floated at water level, allowing hunters to hide below the surface in the "coffin." With decoys set nearby, the hunter would await an incoming flock and then fire as the birds flew by.

The sinkbox hid hunters so well that the state outlawed its use, says Rumley.

To get a close-up of life on the water, you can watch a short film featuring a local fisher, trapper and others. Ann Braddy, a Pungo Creek crabber, describes her long workday. "I fish 400 crab pots," she says. "My days start at 4:30 and end at 9 or 10. Sometimes you circle. Sometimes you straight line."

Kirby Avery, a Bath trapper, sums up the animals' role in the ecosystem. "The best teachers are animals," he says. "They go slower and tell more about their habitats."

Other exhibits take a hard look at how humans can damage estuaries. In the "Signs of Stress" display, a large mural of an Ocracoke marshland is fragmented to show its vulnerability to human impact. Another



Right: The Tar-Pamlico Region and Tar River exhibits feature a variety of aquatic animals and plants.

exhibit focuses on general types of pollution — from toxic chemicals to sediment.

After leaving the building, you can stroll on a 75-foot boardwalk overlooking the Pamlico River. In the distance, cypress, oak and gum trees outline Castle Island, used for docking steamers during the Civil War.

The estuary was conceived by local citizens and Washington town officials in the early 1990s when they began a fundraising drive. After the Partnership for the Sounds formed in 1993, the group took over the project.

The partnership grew out of four grassroots movements. "A handful of community leaders from Tyrrell, Hyde, Beaufort and Bertie counties were all trying to promote environmental projects on their own," says Woolard. "Jonathan Howes (former secretary of the N.C. Department of Environment and Natural Resources) recognized that everyone had a single mission and suggested forming a group for the region."

The new coalition developed a plan to stimulate the local economy in the Albemarle-Pamlico region through nature-based tourism and unique environmental

education centers.

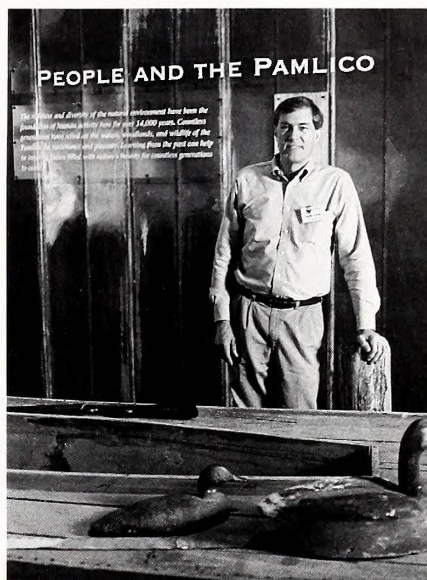
The Albemarle-Pamlico region is one of 28 components in the National Estuary Program, which encourages local communities to take responsibility for water quality and environmental problems. Administered by the U.S. Environmental Protection Agency in agreement with the N.C. Department of Environment and Natural Resources, the Albemarle-Pamlico National Estuary Program has offices in Raleigh and Washington.

"The ecology of the region is unique," says Woolard. "There is a mystique to the swamps, wetlands and creeks. They are undiscovered by people. Because the estuaries are off the beaten path, you get a one-on-one connection with the environment."

The estuary, which has received state funding, is the only partnership facility built from scratch. Since the facility opened last year, more than 19,704 people have toured the exhibits. "It is the gateway to the entire Albemarle-Pamlico region," says Woolard. "After visiting it, people can move on to other facilities in different counties. All our facilities offer different ecological experiences."

The oldest facility is Lake Mattamuskeet Lodge in New Holland, built in 1916 as a pump house and later used as a hunting lodge. After shutting down in 1974, it reopened in 1995 as a research and education center on migratory waterfowl.

Columbia is the home of the newly opened Columbia Theater Cultural



Facilities administrator Blount Rumley wants visitors to develop an understanding of how human life has affected the vast ecosystem.

Resources Center, which highlights traditions and ways of life in Tyrrell County. The Walter B. Jones Center for the Sounds, which will focus on pocosins and forested wetlands, is scheduled to open in Columbia in 2000.

This summer, another facility — the Roanoke/Cashie River Center — will open in a renovated building overlooking the Cashie River in Windsor. The 3,500 square-foot facility

will focus on coastal river systems and how to manage important watersheds. It will also have several outdoor attractions, including a wetland pond and boardwalks.

A facility is planned for Oriental, known for its ideal sailing conditions. "The Oriental facility will be made with environmentally friendly techniques and have interactive exhibits," says Woolard. "Since the wind is unique here, we will use the winds as a teaching tool."

All of the Partnership for the Sounds facilities showcase unique features of the Albemarle-Pamlico region and offer a glimpse into a place that you'll never forget. ■

The North Carolina Estuary is at 223 East Water St., Washington. It is open from 10 a.m. to 4 p.m. Tuesday through Saturday. Summer hours are June 6 through Sept. 6, Tuesday-Saturday 10 a.m. to 4 p.m. and Sunday 1 to 5 p.m. Reservations are required for school groups. Admission is \$3 for adults, \$2 for students in grades K-12, and free for preschoolers. For more information, call 252/948-0000.



A Whale of a Network:

Rapid Response Team Assists Entangled Humpback

By Katie Mosher • Photographs by Scott D. Taylor

It's just after dawn. Dallas Rose is hoping that sea mullet will fill his gill nets off Cape Lookout. Instead, his catch is something completely unexpected.

of a new whale disentanglement network along the North Carolina coast.

With the *Lady Jane* crew standing by, the Coast Guard arrives to secure the site. Calls go out to the National Marine

The process is moving like clockwork, thanks to the foresight of commercial fisher Bill Foster of Hatteras and the state Fishery Resource Grant Program, which paid for training and whale-specific tools.

Rescue team members Andrew Read and Andrew Westgate, marine biologists at the Duke lab, were among 30 fishers, scientists and government officials who attended the grant-funded training.

After consulting with NMFS and David Mattila of the Center for Coastal Studies, who led the training, the rescue team arrives on the Coast Guard's *Block Island* about 10:45 a.m.

In the meantime, the Coast Guard helicopter is delivering the equipment, including buoys, radio tags and satellite transmitters, along with the net hooks and knives.

Although anchored by the net, the whale is not in immediate danger, giving the rescue team a chance to put the previously theoretical procedure into action. As the team finalizes a plan, the Coast Guard keeps onlookers at a distance.

By 1 p.m., the team is ready to start the disentanglement procedure from a 19-foot boat from the National Oceanic and Atmospheric Administration. Using grappling hooks and delicate knives, they can snip the net between the whale's dives.

After the fourth dive, the team is able to cut the last piece of netting. The cutting process takes only 40 minutes. The whale immediately takes off, as television cameras catch the escape to freedom.



David Mattila, left, and Bill Foster display the disentanglement tools at the N.C. Commercial Fishing Show.

A young humpback whale gets its tail flukes caught in the netting. The powerful 25-foot whale immediately pulls the 37-foot *Lady Jane* about a quarter-mile, reminding the captain of a scene from the movie *Jaws*.

A veteran of 25 years of commercial fishing, Rose gives the whale some slack and reports the incident to the U.S. Coast Guard. His call starts the first test

Fisheries Service (NMFS), to biologists at Duke University Marine Lab in Beaufort and to national experts in whale disentanglement at the Center for Coastal Studies in Massachusetts, as well as to the N.C. Division of Marine Fisheries.

A Coast Guard helicopter heads to Oregon Inlet to pick up net tools — hooks and knives — and other specialized equipment.

The rapid response to Dallas Rose's March 24 report was heralded up and down the coast. By all accounts, the state's new whale network passed its first test with flying colors.

"It reflects on Bill Foster's wisdom that he got the equipment here. He got the disentanglement network started," says rescue team member Read.

Coast Guard officials agree. "It's handy to have that equipment on the Outer Banks," says Petty Officer A.C. Bennett of the Coast Guard headquarters in Norfolk. "I was impressed at how quickly it came together."

Bennett sees a synergy of equip-

ment and training within the network. Virginia Beach and the northern Outer Banks. Foster likens the young whales to teenagers, who sometimes get into trouble.

"We had one die that was entangled off Hatteras last year," Foster says. "We did not have the equipment and people in place."

The difference this year is like night and day, he says. "We were fortunate that Andrew Westgate had some experience in this before," Foster says. "We are a bit surprised that it worked the first time — but we're happy."

The goal of the \$40,000 fishery grant he received in 1998 is to "promote

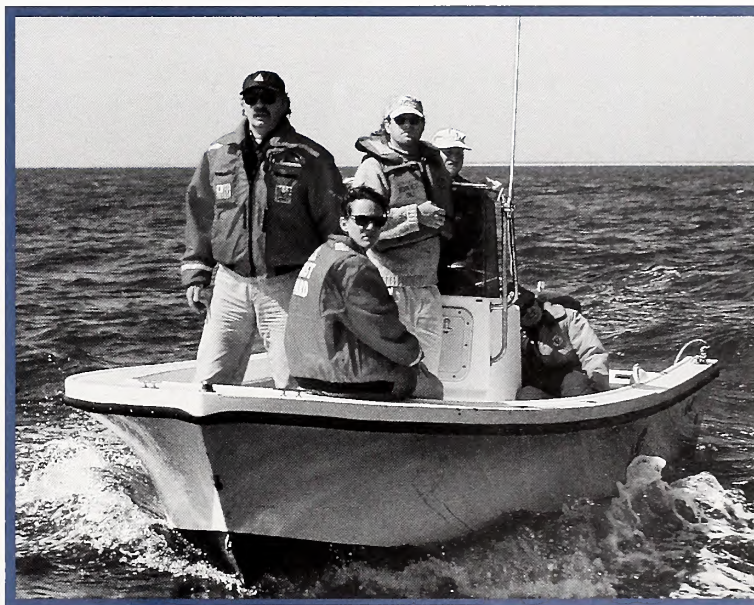
And the new whale network is a prime example of the grant program in action, says Steve Olson, associate director of North Carolina Sea Grant. Sea Grant administers the program, which is funded by the North Carolina General Assembly.

"The program is designed to fund research and find solutions to problems identified by those who make their living on the water," Olson says. "The instincts and intuition of those involved in the fishing industry are crucial factors in resolving a variety of coastal issues."

The Fishery Resource Grant Program was established in 1994 by the



The rescue team prepares the hooks, knives and transmitter buoys.



A smaller boat lets the team get close to the whale.

ment and training within the network. "We are trained at saving lives at sea — but we are not used to a patient quite this size," he adds.

In this case, the team did not need all the available equipment, including an inflatable boat with an outboard. But more complicated rescues could come up.

Juvenile whales are known to winter in the mid-Atlantic, usually near

a partnership between fishermen and the various agencies involved to provide stewardship for this special resource."

To draw attention to the network, Foster and Mattila had a booth at the N.C. Commercial Fishing Show in Morehead City. Taking initiative to solve a problem, then sharing the information with others along the coast is a goal of the Fishery Resource Grant Program.

North Carolina General Assembly. Each year, nearly \$1 million are available to those actively involved in the fishing industries to study issues and determine creative solutions to problems in four major categories: fishery equipment and gear, environmental pilot projects, aquaculture and seafood technology.

Continued

In addition to administering the program, North Carolina Sea Grant oversees out-of-state reviews. The N.C. Marine Fisheries Commission selects the proposals to be funded.

The issue of whale entanglements surfaced five years ago, when the Hatteras-Ocracoke Auxiliary of the North Carolina Fisheries Association convened a public meeting on the issue, Foster recalls. But efforts to coordinate

In recent years, the number of reported entanglements in New England has gone up. Foster suspects that the actual number of incidents is not increasing, but rather that reporting has gone up, as fishers trust the network.

"I think the same will happen here," he says.

"In the past, the tendency was not to call attention to themselves, even though by law they have to report it.

expected procedures. "The fishermen did the right thing. They called it in," Read says.

The team then counts on the Coast Guard to secure the site as the exact plan is prepared.

"People want to get in the water with the whale. That is very, very dangerous," Read says. Untrained rescuers could get caught in the net themselves and pulled down when the whale dives. "The power of these animals is amazing," he says.

Federal law also keeps would-be heroes at bay. Because humpback whales are considered a threatened species, only persons certified by the NMFS are allowed to get close to the animal. The training organized by Foster provided that certification for the rescue team.

From that point, it was a process of following procedures. "You don't want to get in a hurry," Foster says.

"The hardest thing is to get people to slow down and to follow procedures — not only for their safety but for the safety of the whale. You don't want them to spook the animal."

The success of the first disentanglement will draw attention to the need for the network. Foster soon will look for funding to purchase primary net tools and buoys for several locations along the coast and to encourage fishers to take ownership in the network.

"This grant got it started. We have to come up with a way to keep it going," he says. "We hope we will never have to do it again — but we know that won't be the case." □

For more information on the whale disentanglement network training, call Bill Foster at 252/986-2430. To contact the Center for Coastal Studies, call 508/487-3622.

For more information on the Fishery Resource Grant Program, call North Carolina Sea Grant at 919/515-2454 or 252/247-4007.



Once the netting is cut, the whale swims free.

various agencies and offices were not fruitful.

More recently, Foster was appointed to a large whale take-reduction team, where he learned of Mattila's efforts with the Center for Coastal Studies. In New England, many of the entanglements involve right whales, which are considered on the brink of extinction as the population hovers at about 300.

There is a threat of severe penalties for injuring a whale," Foster says.

To encourage more fishers to be trained in Level 1 or Level 2 response, Foster expects to offer evening workshops. At these first levels, the fishers can stand by and provide appropriate information to Level 3 responders, including marine biologists, who actually perform the disentanglement.

The March incident followed

Natural Beauties:

Coastal Flora Bountiful

By Odile Fredericks



Laurel Hill Press

Beach Morning Glory, *Ipomoea stolonifera*

On a summer wander along the coast, a glimpse of a wildflower blooming quietly in the sand or grass is a gift from nature for those who seek simple pleasures.

"What a wonderful feeling it is, to happen upon curious and beautiful plants, and the chance discovery of nature's unexpected gifts," says James Ward, a curator with the North Carolina Botanical Garden in Chapel Hill.

"You go out looking and not knowing exactly what you're going to see, and what a feeling of surprise when you see how much is there," he adds.

The coastal plain abounds with a range of summer wildflowers waiting to reveal themselves. Annoying sandspurs attach their prickly selves to your socks. Gorgeous water lilies and mysterious, carnivorous Venus flytraps capture your attention.

Native Americans have long used coastal flora to their advantage. In the maritime forests hugging the coast, for example, they gathered Spanish moss to make cords and floor mats, stuffing for pillows, tinder for fire and absorbent pads to remove cooking scum.

Today, most people seek wildflowers for their beauty in the spring, but the

Continued

NATURALIST'S NOTEBOOK

Laurel Hill Press



Indian Blanket, *Gaillardia*

Laurel Hill Press



Railroad Vine, *Ipomoea pes-caprae*

Laurel Hill Press



Passion Flower, *Passiflora incarnata*

summer also offers opportunities for those willing to brave the heat.

Duke University botany professor Robert Wilbur, a wildflower fan, says the coastal plain's geology and topography sprout hundreds of intriguing wild natives.

"It's a rich flora," he says. "The whole coastal plain has very unique and interesting flora."

Though development encroaches on pristine areas, you can find wildflowers if you know where to look. Here's a taste of what's out there, starting with some of the easiest to spot in June, July and August.

On roadsides and near condominiums, hotels and beach houses:

- **Indian blanket** *Gaillardia pulchella*.

A daisylike flower with red, orange or yellow petals, it is found in relatively dry places such as dunes.

- **Maypops/Passion flower** *Passiflora incarnata*. This ornate, sky-blue flower stays close to the ground and produces a lemon-sized, greenish-yellow fruit in the fall. Some say the flower represents Christian imagery: 10 petals call to mind the 10 apostles who did not betray Christ, and five stamens represent the five wounds inflicted on Christ.

- **Morning glories** *Ipomoea* spp. These vines have funnel-shaped flowers and heart-shaped leaves that trail along the ground in dry soils. The name comes from the often-white flowers that open to welcome the morning but collapse by mid-day.

- **Golden asters** *Chrysopsis* spp. These upright stems of abundant, long-lasting yellow flowers usually grow upright in dry, sandy soils.

- **Yuccas/Spanish bayonets** *Yucca* spp. Members of the lily family, these flowers have long, pointed leaves in an evergreen basal rosette. From the leaves emerges a stalk three to five feet tall, covered with six-petaled white flowers.

- **Thoroughworts** *Eupatorium* spp. Upright plants two to four feet tall sport

flat-topped clusters of small, white flowers. "Individual flowers are very small, but there are lots of them so they make a very obvious show to attract pollinators," Ward says.

On frontal dunes and areas that lie between the high tide mark and beach houses:

- **Sea oats** *Uniola paniculata*. The signature plant of the frontal dunes, sea oats bloom in the summer when their pale green flowers and fruits often pass unnoticed. As the season goes on, they turn straw-colored. Resistant to salt spray, sea oats stabilize the dunes, so avoid walking on or picking them.

- **Sandspurs** *Cenchrus* spp. Wild-flowers that most people try to avoid, sandspurs are not known for their flowers, but for their fruit. These are covered in long, barbed spines that stick to clothing and help the plant get around to new sites.

In wet areas close to the ocean or sound or in roadside ditches:

- **American water lily** *Nymphaea odorata*. This beautiful, fragrant perennial has large, roundish to heart-shaped leaves that float on the water. The creamy white flowers are three to six inches across and remain open for days.

- **White-topped sedge** *Dichromena colorata*. Although most sedges look like grasses and don't have showy flowers, this one is striking, with floppy, white, thin bracts that surround very small flowers. Sedges can be easily identified because their stems are triangular rather than round.

- **Pickrel weed** *Pontederia cordata*. Found in standing water or very wet soils, this native perennial grows two to three feet tall and produces a very upright spike of blue flowers.

- **Cattail** *Typha latifolia*. This plant can grow to six feet tall and has long, green

Laurel Hill Press



Hatpins, *Eriocaulon*

Laurel Hill Press



Sundew, *Drosera*

The Nature Conservancy



Venus Flytrap, *Dionaea muscipula*

leaves out of which grows a stem with a dense cluster of flowers shaped like a cylinder. Indigenous people ate its roots and young stems as a vegetable, and used the pollen from its male flowers in bread making, Ward says. The stem supports both male and female flowers. When they first emerge, the female flowers are a light tan, but turn chestnut brown as they mature. A smaller cluster of male flowers grows above this brown cylinder, but falls off after the pollen is shed, leaving behind a thin stalk.

In the Nature Conservancy's Green Swamp Nature Preserve, a long leaf pine savanna in Brunswick County:

- **Pitcher plant** *Sarracenia purpurea*. Most pitcher plants flower before June, but you might still see the purple pitcher plant blooming in early summer. Its beautiful reddish and burgundy flowers have five petals and are on stalks that rise about a foot from the ground. A carnivorous plant with squatty tubular leaves, it has nectar glands that entice unwitting insects. The pitcher plants digest the insects' soft body parts to get nitrogen, which is generally lacking in the soils where it grows. The leaves range from slightly purple to a deeper hue.

- **Venus flytrap** *Dionaea muscipula*. Found naturally only within 50 to 75 miles of Wilmington, the Venus flytrap is an oddity — a plant that bites back. Of all carnivorous plants, it is the only one you can easily see in action, as it traps insects by snapping shut its leaves, gradually squeezing their bodies and sealing them in a digestive vat. Its leaves, which are sometimes red inside and laced with nectar, are thought to be the lure.

- **Sundews** *Drosera* spp. These flowers vary from white to pink, depending on the species. The leaves' surfaces are covered with glistening sticky droplets that capture small insects.

- **Yellow milkwort** *Polygala lutea*. With compact heads of attractive orange flowers on stalks six to 10 inches tall, this plant's name is a misnomer. Early Europe-

ans thought them to be yellow, based on the dried specimens they received.

- **Hatpins** *Eriocaulon* spp. Named for their resemblance to old-fashioned hatpins, these white flowers form a tight cluster that looks like a flat-topped button atop a very slender stalk. □

Learn More About Wildflowers and Other Coastal Plants

Interested in wildflower walks throughout the year? Check with a nearby local, state or national park. The following groups and organizations also occasionally organize coastal field trips:

The North Carolina Botanical Garden in Chapel Hill, 919/962-0522;

The Nature Conservancy of North Carolina, owner of the Green Swamp Nature Preserve, 919/403-8558;

The North Carolina Wildflower Preservation Society in Raleigh, 919/834-4172; and

The North Carolina Maritime Museum in Beaufort, 252/728-7317.

To learn more about a variety of coastal plants, order a North Carolina Sea Grant publication:

- **A Guide to Salt Marsh Plants Common to North Carolina** is a teaching guide to the herbs, vines, grasses and shrubs found in North Carolina marshes. UNC-SG-81-04; 32 pages; illustrated; \$1.50.

- **A Guide to Ocean Dune Plants Common to North Carolina** describes and illustrates the herbs, vines, grasses, shrubs and trees found on and near the North Carolina dunes. UNC-SG-87-01; 80 pages; \$4.50.

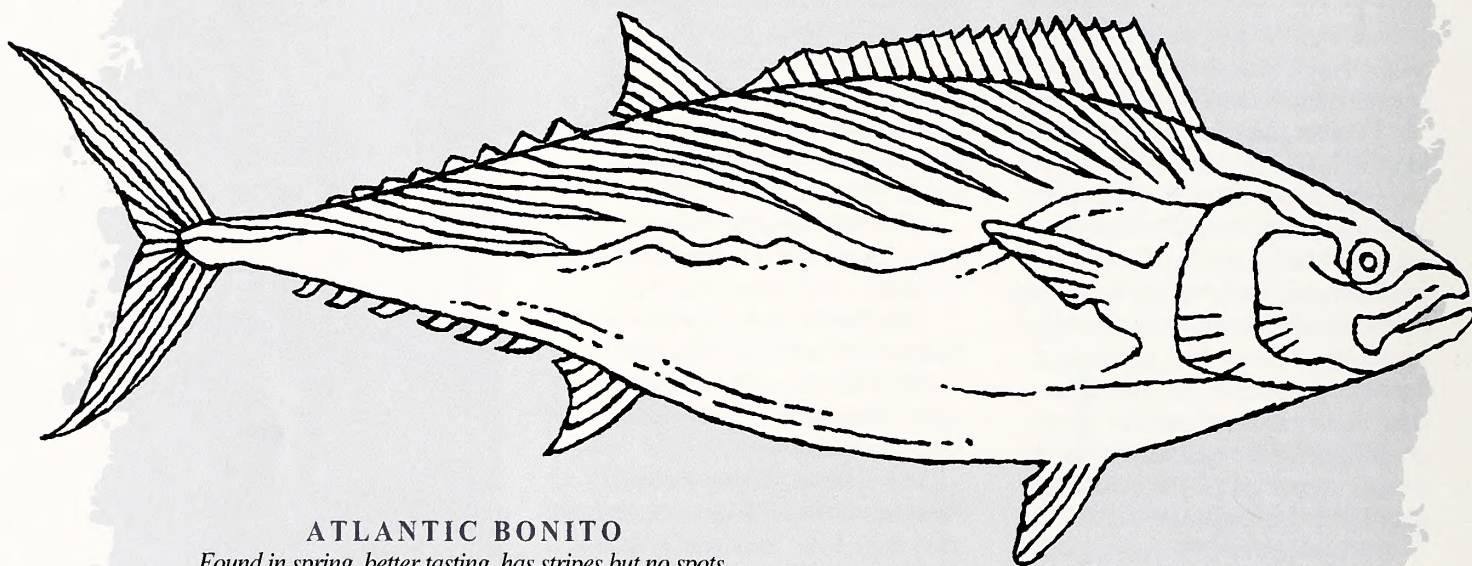
- **Seacoast Plants of the Carolinas for Conservation and Beautification** is a handbook on the use of plants for landscaping and stabilizing coastal soils. UNC-SG-73-06; 206 pages; \$4.50.

Make your check payable to North Carolina Sea Grant. Send your request to North Carolina Sea Grant, NCSU, Box 8605, Raleigh, NC 27695-8605. For more information, call 919/515-2454.

Tuna Confusion:

Distinguishing Atlantic Bonito from Little Tunny

By Renée Wolcott Shannon



ATLANTIC BONITO

Found in spring, better tasting, has stripes but no spots.

It's a case of mistaken identity. Every May, when the water first gets warmer, and again in September and October, when it's starting to cool off, heavy-bodied fish with silver bellies and red flesh school in our sounds. They are members of the tuna family and many people mistake them for the same species, but Atlantic bonito and little tunny are entirely different.

"In May off our coast, we see the Atlantic bonito," says Jim Bahen, recreational fisheries agent for North Carolina Sea Grant. "It's the first fish we

see coming in to feed in numbers." The fish reaches 4 to 5 pounds, topping out at 27 pounds. Atlantic bonito have dark squiggly lines on top, and common names for them include "little football," "striped ape" and "bonito."

Some people also call Atlantic bonito "little tunny" or "false albacore," which is caught in the fall of the year. Little tunny is another small fish, weighing up to 15 pounds. Tunny have the same squiggly stripes on their dorsal sides, but they also have dark spots on their bellies. "Another name for the little

tunny is 'spotted bonito,' to further confuse things," says Bahen.

"The little tunny is an extremely popular fish in Carteret County, and it's found in Beaufort and Bogue inlets. Sometimes you can catch it from the beach, and fishers converge on it."

Of the two species, the Atlantic bonito is better to eat, so early summer fishers are in luck. Watch for the fish at dawn and at dusk in deeper water, where bonito feed on juvenile fish such as silversides, anchovies, alewives and menhaden. Birds are attracted to the leftovers, so schools

of bonito are often marked by diving gulls and terns. "Bonito stay with the bait, so watch the bait," Bahen says.

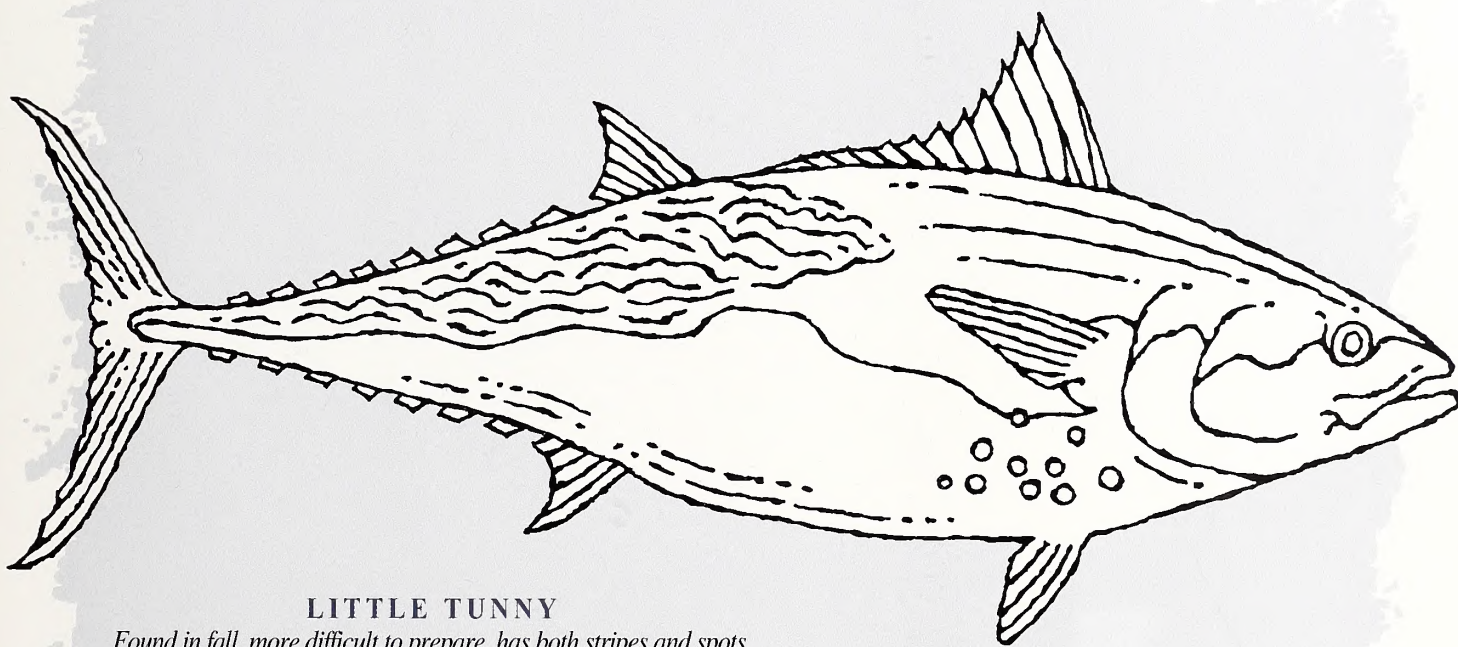
Originally, the bonito's worth as a food fish went unnoticed, and charter fishing boats often used them as strip bait. "But it's a myth that the fish is not good," Bahen says. In the last five to 10 years, the bonito fishery has become

catch a fish on light tackle," Bahen says, "but breaking a line or fighting the fish for too long is bad. You can ruin the fish before you bring it to the boat." He prefers an 8- to 10-pound line for catching bonito. He also recommends using a bite tippet or abrasion-resistant leader, since both fish have teeth and can chafe the line.

Catch-and-release methods are

quickly, stick a knife into it right below the pectoral fin or cut a ring around the base of its tail. If you have time, gut the fish as well. Pack the fish in ice slush in a cooler for the boat ride back to shore.

Atlantic bonito can be prepared much like yellowfin tuna. Broil it, bake it, or make tuna salad out of it by filleting and parboiling the meat.



LITTLE TUNNY

Found in fall, more difficult to prepare, has both stripes and spots.

more popular, especially with saltwater fly-fishing setups.

When fishing for bonito, sight cast with light tackle and a fly, and perhaps some trolling, Bahen recommends. "With tackle, match the size of the artificial lure to the size of the bait as best you can. Fly fishers can really emulate bait." Other kinds of bait include spoons or jigs, and if fish aren't biting, "dredging" with a fly rod and a sinking line may reach below the surface to the Atlantic bonito or little tunny lurking below.

"It's considered more sporting to

especially important when angling for a schooling fish like Atlantic bonito or little tunny. "Establish what you need and return the rest," says Bahen. "Since it's a school fish, you could get carried away and catch a boatload of them. But don't let them go to waste."

For the fish you decide to keep, it's important to bleed and ice them as fast as possible. Both Atlantic bonito and little tunny are warm-blooded fish with red meat; if they aren't bled and chilled immediately, their body heat will cause the meat to spoil. To bleed the fish

Little tunny, which appear along our coast in the fall, are more difficult to prepare. They have a stronger "fishy" flavor, which can be avoided by cutting out the "blood line" or dark meat along the spine and near the kidneys. This difference in flavor, the spots on its belly, and the time of year when the fish is found mark the only distinction between the tunny and its bonito cousin.

"The fishing is about the same," says Bahen. "Use trolling, sight casting, and the same lures and artificial bait. Just know that the fish are two separate species." ■

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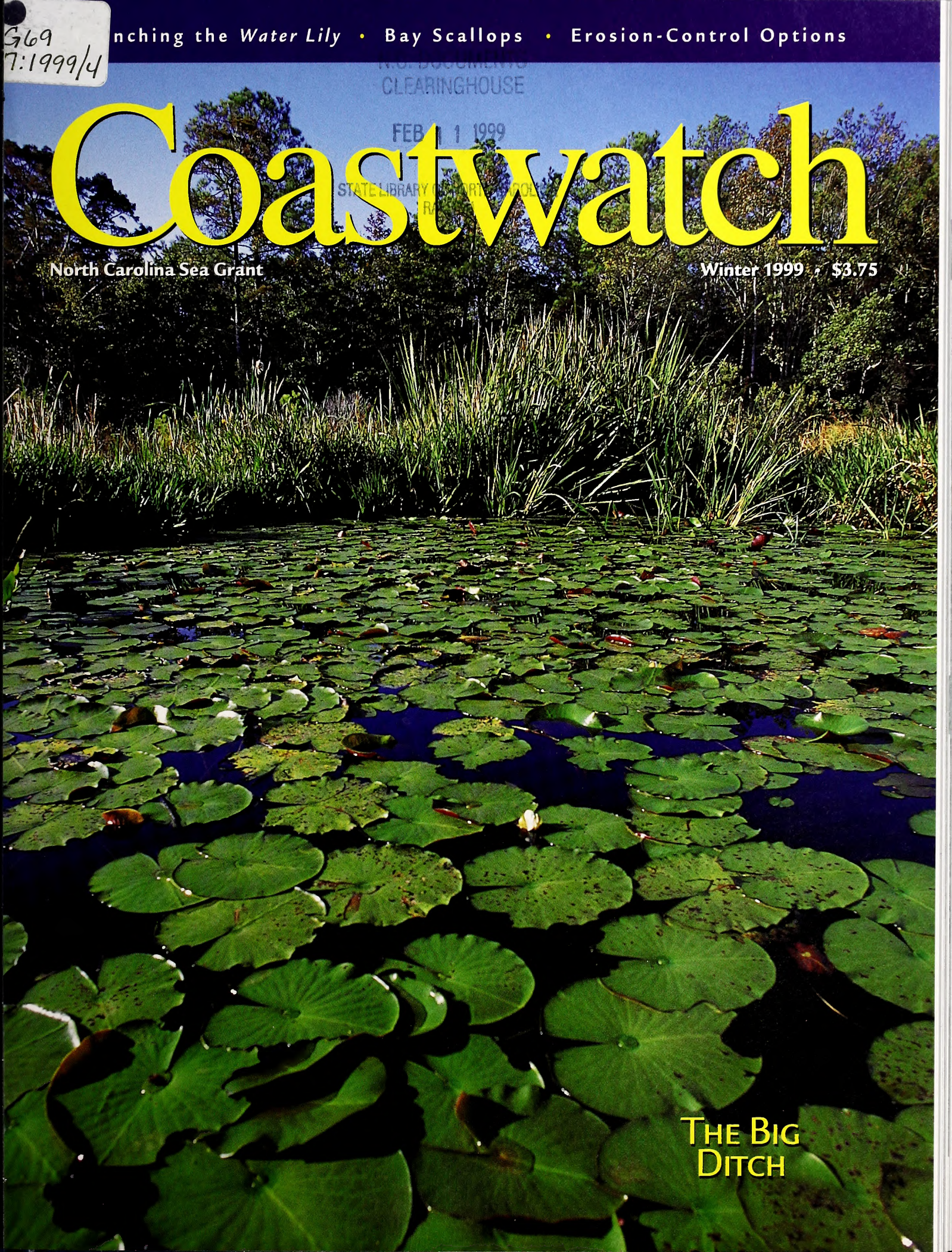
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THE BIG
DITCH

From the Editor

Settling In

It seems like the arrival of 1999 has been lost amid Y2K fever. The year 2000 may herald mystery and intrigue, but here at North Carolina Sea Grant, we will take full advantage of 1999.

This spring, we expect to name a new associate director of research, a move that will bring us back to full staff. I am one of four new staff members who joined Sea Grant last fall.

Steve Olson, our new associate director for outreach, arrived from Oregon in November with a strong sense of North Carolina Sea Grant efforts. As director of the National Coastal Resources Research and Development Institute, he oversaw funding for a variety of demonstration projects here. The Tar Heel ties run even deeper in his home — his wife, Laura, grew up in Greenville and attended East Carolina University.

We four “new kids on the block” found ourselves learning much about the entire program in a very short time. In early December, North Carolina Sea Grant hosted a panel of experts as part of a national effort to review Sea Grant programs across the country. To show the depth and breadth of the program here, we chose to share a series of Sea Grant success stories.

The entire staff, along with researchers and coastal residents who put Sea Grant ideas into practice, provided background on topics from water quality to seafood technology, aquaculture to coastal hazards, fishery gear innovations to marine education.

At times our task seemed overwhelming, but the coastal tour itself was a wonderful introduction to the people who make Sea Grant tick. Our two-day adventure started in Wilmington and ended in Lake Mattamuskeet. Time constraints kept us from continuing to the Outer Banks, so we brought a Hatteras clam farmer



Herman Lankford

inland to share his success story — a rake-your-own clams venture.

You may wish you could have tagged along on our whirlwind tour, but regular *Coastwatch* readers have already been transported to the locations of these successful Sea Grant projects.

The tour folders were filled with *Coastwatch* articles that told readers of the rise of hybrid striped bass farms and efforts to make coastal homes safer. Stories noted the arrival of bluefin tuna, implementation of new seafood regulations and the popularity of skimmer trawls.

As you may have gathered, my welcome to Sea Grant has been hectic. I could not have made the transition without the strong support of helpful colleagues, especially Jeannie Faris Norris.

Coastwatch readers have long appreciated Jeannie's fine writing style. What you may not have seen so directly has been her keen eye for editing and design, her ability to help writers make action come alive on the written page and her smiles while she manages multiple projects with ease. Her patience undoubtedly will serve her well as she prepares for a new career in nursing.

Another *Coastwatch* regular is also charting new adventures. Historian David Cecelski has added a unique perspective to our pages. He has shed light on the roles of lifesavers and photographers, gardeners and midwives whose individual efforts combined to shape coastal life as we know it today.

David has a historian's heart, but he has at least one eye on the approaching year 2000. He expects to see a collection of his columns published next spring.

In the meantime, welcome to 1999, courtesy of *Coastwatch*. ■
Katie Mosher, managing editor

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Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports several research projects, a 12-member extension program and a communications staff. Ron Hodson is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina. *Coastwatch* (ISSN 1068-784X) is published bimonthly, six times a year, for \$15 by the North Carolina Sea Grant College Program, North Carolina State University, Box 8605, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095. E-mail: kmosher@unity.ncsu.edu. World Wide Web address: http://www2.ncsu.edu/sea_grant/seagrant.html. Periodical Postage paid at Raleigh, N.C.

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Table of contents photo of Pamlico Sound oysters by Michael Halminski.

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COASTAL TIDINGS

Olson Named New Outreach Director

Herman Lankford

North Carolina Sea Grant has a new outreach director steering the course for the extension and communications staff.

Steven G. Olson, former director of the National Coastal Resources Research and Development Institute (NCRI), started his new position in November. Olson's experience includes oversight of North Carolina's hybrid striped bass demonstration project while at NCRI.

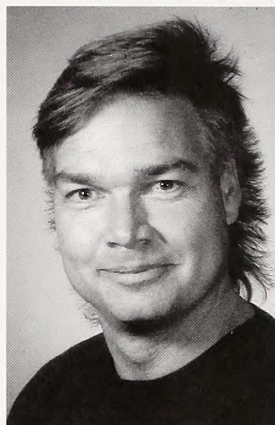
From 1994 to 1998, Olson led NCRI, which promotes environmentally responsible economic development in coastal regions through research and community/industry outreach projects. He also helped facilitate the development of new coastal and marine technologies.

Olson replaces Jim Murray, now director of the National Sea Grant Extension Program in Silver Spring, Md.

In his new position, Olson supervises Sea Grant's extension agents, educational program and communications staff.

"We're very happy to have Steve join the North Carolina Sea Grant staff," says Sea Grant director Ron Hodson. "He brings with him extensive experience in coastal and marine policy and administration and community outreach. One of Sea Grant's priorities is improving community input."

Olson's first order of business is to



Steve Olson

travel the coast to assess the needs of Sea Grant extension staff and coastal communities. "The future of Sea Grant will hinge on its ability to meld together a high-quality, peer-reviewed research program with an aggressive outreach effort," he says.

Increasing the visibility of North Carolina Sea Grant is also high on Olson's agenda. "My goal is to make North Carolina

Sea Grant the primary source for timely and accurate information about the state's coastal and marine issues," he says. "With the expertise and experience of our staff, we can continue to be a clearinghouse of information for our state's citizens."

Educated in wildlife management and natural resource policy, Olson received a master's degree in 1983 from Colorado State University. From 1987 to 1988, he was a Dean John A. Knauss Sea Grant Fellow in the U.S. House of Representatives, where he worked on budgets for the U.S. Fish and Wildlife Service and the National Marine Fisheries Service.

Olson has held other positions in Washington, D.C., including the directorship of the marine and environmental affairs division of the National Association of State Universities and Land-Grant Colleges. He also worked at the National Oceanic and Atmospheric Administration.

—A.G.

In the Next Issue of *Coastwatch*

Few regions of the state have a sporting legacy to match that of Currituck Sound. From the mid-19th century to the present, Currituck's waters have served as a haunt of rich Northern industrialists, gunning grounds for market hunters and philosophical birthplace of Ducks Unlimited. In our next issue, T. Edward Nickens travels to the Currituck past for a look at the region's waterfowl heritage and how it influenced state and national conservation initiatives.

COASTAL TIDINGS

Raleigh School Wins Ocean Mural

Courtesy of the Wyland Foundation

Don't look for it on any atlas, but there is a new ocean — in Raleigh.

Leesville Elementary School boasts a new ocean mural, a tribute to the 1998 Year of the Ocean. Leesville students were the North Carolina winners in the national Ocean Challenge contest sponsored by the Wyland Foundation. One school in each state was selected to receive a mural and a special program on oceans.

During an October visit, a mural artist known simply as Wyland painted a humpback whale for the mural. Students added other Atlantic Ocean sea life — hammerhead sharks, manatees, sea horses, turtles and angelfish. The final mural was a diptych — two pieces divided by a hallway.



This Leesville Elementary School student adds a sea creature.

Together they form a single piece of art.

The Leesville students' interest in oceans is not new. Each year, fourth graders take a nine-week coastal studies unit that includes water quality, marine life and coastal ecosystems. The unit culminates in an overnight field trip for hands-on research at the coast.

In addition to the mural, several Raleigh students offered readings from Wyland's latest book for the *Ocean Challenge* documentary.

To learn more about the Ocean Challenge and Wyland's visit to Leesville Elementary, check out the Web site at <http://www.wylandfoundation.org/tournc.html>.

— K.M.

Fishery Resource Grants Blend Experience, Research

Fishers have observations, intuition and hypotheses from years of experience on the water. Scientists have research methods to gather and analyze data.

Put them together and what do you get? Innovative solutions to fisheries issues, courtesy of the state-funded Fishery Resource Grant Program.

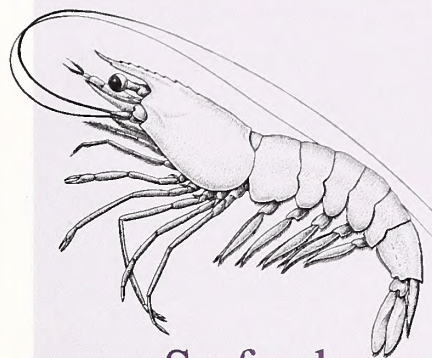
The North Carolina Marine Fisheries Commission will soon select the 1999 grant recipients from applications that meet the Jan. 15 deadline. State legislators have appropriated \$1 million annually for the program, which is administered by North Carolina Sea Grant.

Fishers who have problem-solving ideas may apply for the grants. Applicants must be active in commercial or recreational fishing, or have endorsement from and involvement with those active in the industry.

Sea Grant helps to match applicants with researchers at North Carolina universities who can suggest appropriate research and data-analysis methods.

To learn more about an innovative study of the environmental impacts of inshore trawling, funded by a Fishery Resource Grant, turn to page 32.

— K.M.



Seafood Allergies Common

Are you allergic to seafood or other kinds of food? The Food and Drug Administration (FDA) estimates 160 foods cause allergic reactions in sensitive individuals. Milk, eggs, peanuts, shellfish, tree nuts, soybeans, wheat and fish account for 90 percent of all severe allergic reactions.

In the United States, an estimated one-tenth of 1 percent of consumers are allergic or at risk of developing an allergy to seafood, according to Samuel Lehrer, a researcher at the Tulane University School of Medicine.

Finfish allergies are more common in children, while adults seem to be more sensitive to shellfish. One seafood that can cause allergic reactions is sulfite-treated shrimp. Fishers use sulfites to combat discoloration of shrimp after harvest.

Consumers who are allergic to sulfites may experience cramps, nausea or vomiting. Those with a severe reaction may suffer breathing problems or shock.

To protect consumers at risk for sulfite allergies, the FDA's Hazard Analysis and Critical Control Point (HACCP) regulations require the labeling of all sulfite-treated shrimp. — A.G.

AROUND THE NETWORK:

Scientists Discover Genetic Similarities Between Humans and Dolphins

Texas A&M University scientists, in a project funded by Texas Sea Grant, are comparing human chromosomes to those of dolphins and finding that the two share many similarities.

"We've found that the dolphin genome and the human genome are basically homologous," says researcher David Busbee. "It's just that there are a few chromosomal rearrangements that have changed the way the genetic material is put together."

The scientists are trying to determine if the same similarities are true for individual genes on the chromosomes.

"We expect there are a number of places where the dolphin genome will reflect differences with the human genome," Busbee says. He hopes these differences will tell scientists how long ago dolphins and humans embarked down different branches of the evolutionary tree.

According to their genes, Busbee says, dolphins are more closely related to cows, antelopes and giraffes, and the domestic pig may be their closest relative. If scientists can determine the genetic information shared by humans and dolphins, he says, then they may be able to save time in constructing a genetic map of dolphins.

Two Scholars Win Knauss Fellowships

Two scholars from North Carolina are heading to Washington, D.C., after being selected for the 1999 Dean John A. Knauss Marine Policy Fellowship. Created in 1979, the fellowship offers a unique educational experience to students with an interest in marine, ocean and Great Lakes resources and in the national policy decisions affecting those resources.

The fellowship, sponsored by the National Sea Grant Program, matches highly qualified graduate students with hosts in the legislative or executive branches of the federal government.

North Carolina's recipients are Catherine Wannamaker and Kathleen Moore.

Wannamaker completed a master's degree in the Zoology Department at North Carolina State University in 1998. Because of her interest in policy, she also

completed an interdisciplinary minor in environmental law and policy.

Her thesis, which focuses on fish response to hypoxia, already has generated interest from researchers at other institutions across the country. Wannamaker is assigned to the Senate Commerce, Science and Transportation Committee.

Moore is finishing a master's degree in environmental management at Duke University's Nicholas School of the Environment. Her master's project researches local governments' role in addressing opposing viewpoints and creating a proactive, effective coastal policy.

Moore is using a proposed ocean outfall to assess local governments' ability to address a regional issue. She is assigned to the National Marine Fisheries Service Office of Protected Resources. — A.G.



Kathleen Moore



Catherine Wannamaker

Democracy Betrayed

If you've enjoyed reading David Cecelski's coastal history columns in *Coastwatch*, be sure to find a copy of his latest book, *Democracy Betrayed*.

On Nov. 10, 1898, the streets of Wilmington were filled with turmoil as white supremacists, marching in a procession 2,000 strong, battled the city's black citizens in an explosion of violence that has since been referred to as the Wilmington race riot of 1898.

One hundred years later, Cecelski and historian Timothy Tyson clarify that the racial violence that besieged the bustling port town was no "riot." What happened in Wilmington, the co-editors write in their introduction, "was part of an orchestrated campaign to end interracial cooperation, restore white supremacy, and in the process assure the rule of the

state's planter and industrial leaders."

Democracy Betrayed: The Wilmington Race Riot of 1898 and Its Legacy marks the centennial of the racial violence. The collection of essays is edited by Cecelski and Tyson with a foreword by John Hope Franklin. The book "is intended to draw public attention to the tragedy, to honor its victims, and to bring a clear and timely historical voice into the lively debate over its legacy," write Cecelski and Tyson. The editors comment that they hesitated to refer to the racial violence in Wilmington as a "riot" in the subtitle of the book, but they reluctantly settled on the term to ensure that it would be understood.

Democracy Betrayed is available from bookstores or the University of North Carolina Press at 800/848-6224. It costs \$16.95 in paperback and \$45 in cloth.

Low-Cost Erosion Protection — and it's Environmentally Friendly

North Carolina Sea Grant has perfected a low-cost wooden breakwater design to control estuarine erosion. The design calls for the property owner to plant and maintain a salt marsh on a previously eroding beach and build a small structure offshore. The structure helps to establish and protect the salt marsh. Fifteen or 20 feet of marsh will, in turn, prevent erosion of upland shorelines.

Using this marsh/breakwater design, an estuarine property owner can reduce erosion-control costs from about \$100 per foot for a bulkhead to less than \$40 per foot. It's also one of the few coastal construction efforts that scientists, coastal managers and property owners agree is an environmental asset, says Spencer Rogers, North Carolina Sea Grant's coastal erosion and construction specialist.

Shoreline Erosion Control Using Marsh Vegetation and Low-Cost Structures



BROOME • ROGERS • SENECA

Between 1992 and 1996, Sea Grant worked with NC State University's Department of Soil Science, Albemarle-Pamlico Estuarine Study, N.C. Cooperative Extension Service and the N.C. Sediment Control Commission to establish more than a dozen demonstration sites from Currituck to Brunswick counties.

Sea Grant and NC State University have published a planting

and construction guide. *Shoreline Erosion Control Using Marsh Vegetation and Low-Cost Structures* costs \$2.50. Make your check payable to Sea Grant and mail it to North Carolina Sea Grant, NC State University, Box 8605, Raleigh NC 27695-8605. Ask for UNC-SG-92-12. Or contact Rogers at 910/256-2083. Turn to page 24 for a related story.

—J.F.N.

Bycatch Defined

The word "bycatch" makes most people think of the unwanted fish that are pulled in during shrimp trawling or net fishing. Some worry that the ratios of bycatch to desired catch are too high. Five pounds of bycatch to a pound of shrimp can be a frightening statistic.

But bycatch is any catch that isn't the target for fishers. "Bycatch doesn't even have to be fish," says Jim Bahen, a North Carolina Sea Grant fisheries agent. "Bycatch can be beer cans, old tennis shoes, grass, stumps." All those items contribute to the bycatch weight ratios but have no impact on fish populations.

Another misperception is that only commercial fishers have bycatch. Both recreational and commercial fishers pull in fish they don't set out to catch. For pier fishers, bycatch can mean unwanted dogfish, skates and blowfish. Like commercial fishers, they can throw such fish back. With new developments like the Turtle Excluder Device and skimmer trawl, much bycatch lives to swim another day.

—R.W.S.

Operation Pathfinder Offers K-12 Teachers Summer Opportunities

North Carolina Sea Grant, Virginia Sea Grant and the N.C. Aquarium at Roanoke Island will host the 1999 mid-Atlantic region COAST/Operation Pathfinder. The course for K-12 teachers will be June 19 to July 2 along the Outer Banks of North Carolina and Virginia shores of the Chesapeake Bay. Participants will receive three semester credits.

Teachers from North Carolina, Virginia, Maryland, Delaware, New Jersey and the District of Columbia may apply for 26 in-service slots. Education majors in these states may apply for four preservice spaces.

This fully supported program provides

tuition at North Carolina State University, room and board, a travel allotment, \$300 stipend and resource materials. Oceanography and coastal processes topics will include marine and aquatic habitats, plate tectonics, marine pollution, physical and chemical parameters, deep-sea technologies and marine and aquatic resources.

Participants also will receive training in integrated curriculum development, Web page construction and computational science tools.

COAST is funded through the National Ocean Partnership Program by the Office of Naval Research in cooperation with the

National Marine Educators Association, the University of Southern Mississippi and the National Sea Grant College programs.

Information and application forms can be obtained from Lundie Spence, North Carolina Sea Grant, NC State University, Box 8605, Raleigh, NC 27695 (lundie_spence@ncsu.edu) or Vicki Clark, Virginia Sea Grant, VIMS, P.O. Box 1346, Gloucester Point, VA 23062 (vclark@vims.edu).

The deadline for applications is April 1.

See the COAST/Operation Pathfinder Web site at <http://www.coast-nopp.org/>.

—K.M.

The Big Ditch

A Scenic Maritime Byway

By T. Edward Nickens

Photographs by Scott D. Taylor

The Intracoastal Waterway is a 3,000-mile dredged navigation channel lying just inland of the shoreline of eastern America. The "Big Ditch," as it is sometimes called, runs unfettered from New York to Florida, then north and westerly along the Gulf coast to Brownsville, Texas. It's a critical lane of protected water that skirts the Atlantic's storm tides and rough seas. If you are a tugboat captain, you might use the waterway to push barges loaded with phosphate or pieces of a space shuttle. If you are a shrimper, you might use the waterway for access to inshore trawling grounds. If you own a power or sailing yacht, you might use the channel to make the run from your home in the North to, well, your other home in the Caribbean.

Or if you're like us, and what you have is a 21-foot Bayliner, a full tank of gas and three days to burn, you might spend a few waterway days poking around the ruins of old logging camps and moseying through local museums where the headliners are a pair of fleas dressed up like a bride and groom. You might make time to chase rattlesnakes, eat in Victorian mansions, and putter past decrepit fish houses and gleaming 100-foot power yachts. And along the way you just might get a glimpse of a separate world that exists on the fringe of the shore, a waterway subculture of grizzled old misfits on gnarly boats, of million-dollar yachts and a 3,000-mile-long neighborhood.





We set out one morning as my friend and boat owner (a lovely combination) Kevin Bellamy backs his runabout into the Alligator River at the U.S. Highway 64 bridge. We are bound for Beaufort, 120 water-miles distant. Our trip will take us from the mouth of the Alligator River to the headwaters of the Pungo, across Albemarle Sound and the Pamlico and down the Adams Creek-Core Creek Canal that connects the fresh water of the Neuse with the brine that flows past historic Beaufort. We have no set schedule but for overnight berths. We have fair skies and the promise of following seas. And we have the good word of the U.S. Army

but first we have to get through a stump-pocked shoreline and into the rarely plumbed waters of Milltail Creek. Bob Webster, a brawny Roanoke Islander with a salt-bleached cap and perpetual grin, guides us. We motor out of the waterway just south of day beacon 18 and ease our way toward shallow water and potential disaster. I scan the shoreline with binoculars while Webster searches for a small cleft in the trees, marked by an osprey nest high in an old snag he recalls from an earlier reconnaissance. We find it — hardly as wide as our boat is long — and hold our breath and trim the motor, knowing that at any moment the propeller

could bury itself into a sunken log, sandbar or alligator.

Then, like a 2,000-pound canoe, our boat drifts across the shallow creek mouth, through the veil of pines and cypress along the shore and into the placid waters of Milltail Creek. Trees clutch at our craft from both sides of the channel, but when I plunge a boat paddle into the tannin-stained



Cypress stand tall in the Alligator River National Wildlife Refuge.

Corps of Engineers, the party responsible for the Intracoastal Waterway, that as long as we stay in the channel marked by the various official green and red markers, there will be plenty of water under the hull.

So I should explain why we are searching for a way out of the famously well-maintained waterway channel 20 minutes after pulling away from the dock. I have heard of a water route from the river to the site of old Buffalo City, a turn-of-the-century lumber town deep in the Alligator River National Wildlife Refuge. Exploring such offbeat nooks and crannies is one of the charms of waterway cruising,

water, the bottom is still too far away to touch. Bellamy drops the motor and we cruise slowly through a canyon of dense foliage. Butterflies flutter in front of the boat. Paisleys of duckweed drift in the channel. A kingfisher flits a few inches from water like black ice, its own reflection chasing it upstream. As we thread the cypress-studded waters, I read aloud from the *Cruising Guide to North Carolina*: "Milltail Creek is a rarely cruised stream that should be entered only by the most adventurous captains" Bellamy grins and guns the motor as great blue herons

Continued

join the kingfisher as our upstream escorts. It isn't Webster's first visit to Milltail Creek, but the wild solitude is still impressive. "Back here," he says, "you'd never know there were seven and a half million people in the state."

But you'd also never know that Milltail Creek was once the site of Dare County's largest town. Around the turn of

dwindled away. The lumber company closed its operations about 1950. Once the saws stopped, the woods began reclaiming its streets. Today there is little left. On stormy days, knowing captains will thread the tiny creek mouth to anchor out of the wind, but mostly Buffalo City is the haunt of herons, a little mud ramp where you can launch a johnboat into the wide waters

the Southeast. Ply the waterway and the world can change dramatically, and with startling speed. Fifteen minutes from wetland wilderness and you can be in the midst of massive shipyards. Squalls can whip calm waters into roiling seas. Fog can shroud markers. And your boat can bump into history in the most unsuspected places.



Remote waterway stretches teem with wetland wildlife.

the century, the Dare Lumber Co. built a lumber camp on the creek shore complete with boardinghouse, hotel, bars and a blacksmith shop. More than a thousand people lived in the tangled wetland swamp forests off Milltail Creek, logging out the great stands of Atlantic white cedar. In time, more than 100 miles of logging railroad were laid through the Alligator's virgin forest.

"There it is," Webster says, pointing to a few old pilings in the woods, all that's left of the village. "Downtown Buffalo City." After a cholera epidemic wiped out most of Buffalo City's workers, the town

where the creek swells into Boat Bay Lake.

But it is a fitting introduction to the Intracoastal Waterway's charms, for this curious boaters' highway happens to pass through a world of startling contrasts.

The waterway isn't so much a single lane of water carved through the coastal plain as a collection of protected canals, creeks, rivers and dredged navigation channels that stitch together the open waters of the Atlantic coastline.

In places, the waterway is as commercialized and urban as the Norfolk waterfront. Elsewhere it threads through some of the most remote countryside left in

We leave Webster back at the Highway 64 bridge and turn south for the big-water run up the Alligator River, the distant shores a haze of green treetops, the wind at our backs, the boat sending plumes of foam from the bow. Channel markers far in the distance sketch out our route, like tiny lighthouses strung across the open water.

Native Americans were the first waterway engineers in North Carolina, for they dug a 10- to 12-mile "haul-over" so they could pull their canoes across the dry land between Clubfoot Creek and Harlowe Creek, creating a link between the Neuse and Newport rivers. Workers in the

colonial era deepened the cut to 5 feet with slaves, mules and sweat, cutting by 75 miles or so the water route from Beaufort landing to New Bern.

But the great colonial effort of channel-building was the one that carved a water route between North Carolina and Norfolk. Any kid in Camden County can tell you that George Washington helped form a company to construct a canal linking northeastern North Carolina and the growing tidewater region.

Long before Valley Forge and the White House, Washington circumnavi-

gated the half-million acres of tangled vine and bog called the Great Dismal Swamp, which lay astride the Carolina-Virginia line. His destiny as national leader usurped his dreams of running a canal through the Dismal, but others picked up the charge. In 1805, the 22-mile Dismal Swamp Canal opened, connecting Deep Creek of the Virginia tidewater with North Carolina's Pasquotank River. Today it is the country's oldest man-made waterway still in existence and a crucial link in the Intracoastal Waterway.

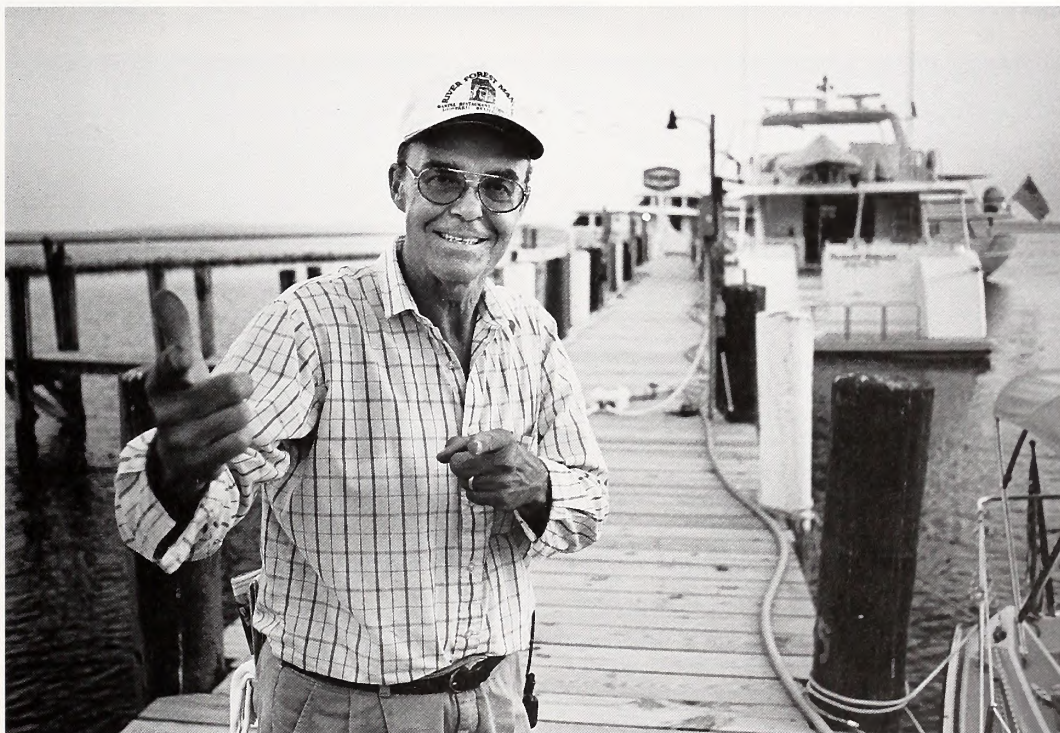
From 1814 on, an incredible variety of boats plied the Dismal Swamp Canal, from barges bearing bacon and brandy to antebellum steamers to steel-hulled petroleum tankers that used the canal during World War II to avoid German submarines in the Atlantic. There was even the James Adams Floating Theatre, a 700-seat showboat fashioned from a wooden barge. In the meantime, two centuries of efforts to drain the swamp and convert the land to agricultural use were alarmingly successful. Only about 107,000 of the Dismal's original half-million acres remain.

Such a fate has continually threatened the sprawling pocosins south of the Alligator River. Pocosins are a type of wetland that once covered hundreds of thousands of acres of Eastern North Carolina, but they have dwindled in the face of widespread ditching and draining. Not so the tangled thickets that border the Alligator River-Pungo River Canal. From the headwaters of the Alligator we cruise along mile after mile of a stick-straight channel that burrows through tangled pond pines and the evergreen shrubs of the pocosins. Deer skitter away into the underbrush; a timber rattlesnake, thick as a

radiator hose, swims in front of the bow. In three hours we pass houses so widely spaced they can be counted on a single hand.

Down the canal and into the wide Pungo River, our route for the day finally feeds us into the harbor at Belhaven. It's as pretty a waterfront as there is on the Carolina shore, built with

Scott Taylor and I shuttle duffel bags to the "annex," where rooms have a charm all their own, even if it is the charm of cinder-block walls mixed with Second Empire reproduction furnishings. We watch the last of the day's light bleed from the Pungo River, to be replaced by the winking lights of a 116-foot yacht moored at the manor's dock.



Greetings from the Belhaven dockmaster

timber money that poured into town when the Roper Lumber Co. opened mills in the 1890s. In 1899, company president John Aaron Wilkinson began construction on an imposing waterfront mansion with an enormous curved portico supported by towering Ionic columns. Today his house is operated as the River Forest Manor, a bed-and-breakfast inn.

As luck would have it — bad luck, that is — guest rooms in the main manor house, with its graceful leaded windows and carved plaster ceilings, are all taken, so Bellamy, photographer

In the morning, we wake to skeins of honking geese over the Pungo River and the green hump of distant wooded points like the prows of great ships in the early mist. The gray-haired lady working the morning shift at the front desk whistles at the bill of the 81-foot yacht *Financial Statement*. She took on more than a thousand gallons of diesel. I prow the quiet parlors of the River Forest Manor, chuckling at the juxtapositions of mounted elk heads and leaping swordfish on a dining-room wall.

But the quizzical and the curious are commonplace along the waterway. Water,

Continued

anywhere, in any quantity, seems to draw the offbeat and the oddball. Add the transient nature of the waterway's denizens and the remoteness of the region it travels in North Carolina, and you have a fertile brew for oddity.

Which helps explain the Belhaven Memorial Museum. I have heard about the museum for years, or I should say, I have heard about its most famous exhibit: a pair of fleas, dressed like bride and

'Do you want this?'" explains museum president Peg McKnight, "she never said no."

But Way said "yes" plenty, and she wound up with a world of weird stuff. It's all housed in the second-floor museum: 30,000 buttons, jars of rocks and arrowheads, stacks of old North Carolina license plates, a watch fob made from the first trans-Atlantic cable, a collection of three dozen rattles from canebrake

able contents with a strip of masking tape lettered "Possum and Tatoes."

It's as much a historical document as any president's letters, for that jar of opossum meat and (I'll bet) sweet potatoes speaks of a time that has passed as surely as the days of oyster tonging in the Pamlico River.

Right there on the banks of the waterway, I am swept back through the years, for with one glance at the collection of bleached pig carcasses and coiled snakes I am suddenly back in Mrs. Lomax's sixth-grade biology class, with my desk situated next to a hundred-foot-tall (at the least) bookcase chockablock with pickle jars in which reside all manner of beasts floating forever in formaldehyde. My love of natural history was born with my face pushed up to those glass doors. I'll argue forever in favor of the historical value of an eight-legged pig in a bottle of alcohol.

I've come to expect such little epiphanies while traveling the Intracoastal Waterway. A trip down this commercial and cultural corridor is nothing if not an



Buttons — 30,000 of them — are a joy to Peg McKnight of the Belhaven Memorial Museum.

groom and visible through a magnifying glass. After breakfast I climb the creaky wooden stairs of the brick Belhaven City Hall with no small amount of anticipation — and no small bit of snickering from Bellamy and Taylor.

For most of her 92 years, Belhaven resident Eva Blount Way collected the flotsam of everyday life. Buttons, old coins, shells, kitchen implements, her own shoes — what began as a packrat's passion turned into a collection of curiosities from around the world. "If anybody ever came to her house and said,

rattlesnakes she killed herself, the head of a pronghorn antelope. We wander through the mazelike exhibits, wonder-struck one moment, cackling the next. I finally find my finely dressed fleas, and through the magnifying glass I can even pick out the bride's parasol.

But when I see a hand-lettered sign marked "Kitchen Artifacts," I realize that there is more to this collection than just the whimsy of an elderly lady. On ramshackle shelves I find rows of pickled okra and corn-on-the-cob, "put up" chicken fat and a sealed jar of unidentifi-

excuse to shed light on dusty corners of coastal-plain history, whether you find them along tangled blackwater rivers or once-prosperous waterfront communities. Like any route that traverses place, the waterway crosses time as well. I've learned to watch for where they intersect. Keep your eyes ever on the channel markers, and you'll miss the best of the waterway.

From Belhaven we head down the wide Pungo River and into the Pamlico, slaloming through crab pots. A shrimp trawler pulls nets through lightly swelling seas while an orange-bibbed waterman

culls the catch in the stern. Hundreds of gulls swirl about the boat. We point the bow south for a few long hours of big-water crossing as we pass sailboats and powerboats queued up across the mouth of Pamlico Sound. These are the vanguard of the "snowbirds," yacht owners who spend the winters in Florida and the Caribbean and the summers up North. Migrating up and down the waterway with the seasonal predictability of warblers and snow geese, these boaters forge their own transient community along the Intracoastal Waterway, trading cul-de-sacs and block parties for anchorage in quiet coves and conversations in ships' stores.

Bellamy and I tied up once in Elizabeth City on another waterway trip, and we caught a glimpse of this subculture when we found ourselves invited to a storied waterway tradition: a Rose Buddies party on the waterfront. Each year, some 2,000 waterway boats stop for the night at Elizabeth City, and each time a handful of new ships docks there a corps of enthusiastic waterway boosters named the Rose Buddies springs into action. They haul food and drink to the waterfront, and waterway cruisers get a rare chance to make contact other than a wave from one boat to another.

That night, the wide Pasquotank River unfurled at our feet like a sheet of hammered silver, sailboats from as far away as Key Largo, Fla., and Montauk, N.Y., were snuggled up to dock, and Bellamy worshipped a gleaming trawler with scrolled wooden rails. While he joined a small group of boaters discussing the finer points of mooring and where to find showers along the waterway, I sneaked about the town docks, moving

from conversations laced with an Irishman's brogue to a New Yorker's accent to a Virginian's soothing lilt. In each of them was a sense of the waterway subculture, of lives lived, for months if not years at a time, on the move from north to south and back again.

I talked my way aboard the *Tockwaugh*, the gorgeous 42-foot Grand Banks trawler that drew Bellamy's eye. The boat was flying both Maryland and

other boaters' privacy." That limits opportunities for real conversation and makes the Rose Buddies parties one of the few times that the waterway community can come together.

Another way is by trading boat cards, and she explained by showing me a business-card file with hundreds of cards emblazoned with illustrations of power yachts or sailboats, their names, owners, lengths and designs. "When we see a boat



The Elizabeth City waterfront is known for its hospitality.

Florida flags. Inside, Joan Nauta, an amiable woman with a quick smile and an excitement about all things boating, explained how the waterway forms a sort of linear neighborhood. She and her husband Walt had made the trip down the waterway seven times, and they had come to relish the Rose Buddies parties. "There is a sense of real community on the water," she said. "You always talk to other boaters who have a boat like yours or a similar dinghy," and everyone helps one another if a motor conks out or a mast fails. "But boaters really try to respect

we recognize, we can pull the card and get the name of the owners and hail them by radio," she explained. "It's a fun way to stay in touch."

As she spoke, I glanced about at a cabin full of polished wood and electronics. Steps dropped down to a bedroom, and there were stacks of newspapers and magazines strewn about and framed pictures on the wall. Just like home. Nauta apologized for the clothing tossed over a chair or two, explaining that waterway boaters "really

Continued

have to strip down to the basics. Life becomes a matter of finding milk, bread and a good laundry."

Of course, we aren't traveling in such luxury as the *Tockwaugh*, but nonetheless there is something decadent about a days-long boat ride over open water, especially when it comes during

again, the world is instantly transformed from open sea and sky to narrow creek, where crab pots are stacked on spits of green marsh, awaiting orders. At the R.E. Mayo fish house in Hobucken, a rambling aluminum-sided structure looming over the waterway, puppy drum sell for \$1.50 a pound and gallons of gas for just over a buck, so we fill our

Cecelski. "Even the homes is gone. We're going downhill."

To be sure, there isn't much traffic at Mayo's, but the lady behind the counter is full of laughter. I leave hoping such a disposition will help sustain the waterway landmark, but the empty parking lot and lifeless docks are hardly positive signs.

As we pull away from the gas dock, we putter past a sleek, pencil-thin sailboat. I have learned on these waterway cruises that when you are on a boat, all other boats become objects of intense scrutiny. To outsiders, this has all the appearances of envy, and sometimes it is precisely that. Most times, though, it is just a kind of deep interest in all things floating. We parse the sailboat's lines, wonder what it would be like to take on heavy seas in the boat, how the decks would fare in rollers.

The owner sticks his head out of a hatch and says, "1904!" just loud enough for us to hear, knowing that we

are smitten by his craft. In the small creek nearby we slow to study the flared bow of a small wooden trawler and wonder if she was built in some waterman's back yard up Snode Creek or Mill Seat Landing. Not many boats like her are around, and few new ones to take her place.

From Hobucken, the waterway courses a few miles farther down a man-made canal, then pours into the estuarine waters of the Bay River. But two miles wide, such protected waters can be deceiving. Once, on a run down the waterway where it bisects Currituck



The Intracoastal Waterway is a main artery for East Coast shipping.

the workweek. We cross the mouth of the Pamlico River, the eastern horizon invisible as a dense haze erases the line between sea and sky. The boat motor thrums against the soles of my feet, the soft thud and thunk of swells against the hull nearly lulling me to sleep. My brain dials down to idle, with just enough output to keep the lungs working, keep the knees bent just-so to absorb the occasional swell. Bliss.

Off the shore of Goose Creek Island we find channel marker 1 and thread the shoals along Reed Hammock into the mouth of Goose Creek. Once

tanks and gab about the store's collection of mounted deer heads and selection of fishers' gloves.

Just this morning in Belhaven, I read an interview with a Goose Creek Islander in the *Raleigh News & Observer*. Odell Spain was an oysterman who grew up and fished in Hobucken. He was the last male descendant of 200 years' worth of Spains to live in the area. Hobucken was once a vibrant fishing center, but no more. "I'm sad when I see these old homes that were once full of people, and all the families is gone," Spain told historian David

Sound, we picked our way through grass beds and sand flats to find a wide bay in which to spend the night. The sun set over calm waters while Bellamy fired up a grill. I tossed out the anchor and unloaded marinated steaks from the cooler. We ate under a bright half moon, then crawled into sleeping bags stretched out on the boat.

When I woke, however, it was not to a sublime sunrise but to black sky and Bellamy's voice straining over a lashing wind and whitecaps pounding the boat hull. "Get the anchor!" he screamed from the stern. "We gotta get into deeper water!" A rising, violent wind had pushed us toward the shore. I leapt to the bow and grabbed the taut anchor line, yelling instructions to Bellamy as he eased the boat into the chop to lessen the tension on the rope. "Forward! Forward! Now to the right!" I screamed directions over my shoulder and hauled rope hand over hand.

Three times we were down to the last few feet of line, but each time the gale caught the bow and whipped it past the buried anchor, ripping the rope from my grip and burning my palms. On the fourth try Bellamy expertly gunned the motor to counter the raging wind, and I finally wrenched the anchor from the mud and heaved it aboard, my arms and legs shaking with fatigue. Only then did I realize that I was standing on the bow in sodden socks and boxer shorts, the rising sun cracking over Currituck Sound in front of me.

It took us another hour to claw through heavy seas and shallow water back to the waterway, where I wormed

into my sleeping bag and huddled behind the windshield as Bellamy threaded us through white-capped froth.

No such trouble is in store on our Neuse River crossing. From the mouth of the Bay River we set a compass course for 120 degrees and plane over gentle swells toward the channel marker at the Neuse River junction, two miles

what longtime waterway cruisers know so intimately. The smokestack of a long-vanished menhaden plant looms ahead, a beacon from the past, and I realize that this waterway road trip is nearly over. But in my hands, in the chart book we used to plot our course, the telltale purple line that marks the Intracoastal Waterway skirts south farther still,



On waterway cruises, all boats become objects of intense scrutiny.

from land. Bellamy and I have spent long tortuous hours on a wind-whipped Neuse, but this time the water is like a silk blanket. Plains of flax-colored marsh stretch to the eastern horizon.

We take a break in the peaceful little sailing village of Oriental, then skirt through the Adams Creek-Core Creek Canal. We have only the quick crossing of the Newport River to funnel us into Beaufort Harbor, perhaps one of the best-loved of the intimate waterway harbors in the route's 3,000 miles.

It is at Phillips Island, in the Newport marshes, that I am struck with

behind Bogue Banks and around Onslow Bay, to Cape Fear and Cape Romain, to the Sea Islands of Georgia and around the horn of Florida.

As we motor through the familiar waters of Taylor Creek, along the Beaufort waterfront, I figure out perhaps the finest thing about the Intracoastal Waterway — finer than its endless parade of boats, finer still than its entrée into lands of endless sky and marsh. It is that every waterway trip's end, no matter the port or harbor, is simply the beginning of another one waiting to be taken. ■



Scott D. Taylor

Mitchell Lewis works on the frame of a sportfishing boat at Alex Willis Boat Construction on Harkers Island.



Houston Lewis stoops over an unfinished wooden boat in a high-ceilinged garage. With his weathered hands, he sands each side, inch by inch, for almost an hour.

Nearby, his brother Jamie Lewis uses a small hand plane to smooth a piece of wood.

Inside the hollow hull of the sportfishing boat, James Lewis Jr., Jamie's son, tinkers with a sensor that will be installed on the boat's bottom to detect fish.

Each day, members of the Lewis family work side by side sculpting their prized boats. By fastening planks and frames one piece at a time, they are keeping alive a Harkers Island tradition that has survived for generations.

When crafting boats, the Lewis brothers rely on skill and materials at hand. Lots of white juniper. Ingenious tools. Precise measurements. Intensive hand work. No telephone or fax machine.

The Lewis brothers build most boats by a time-honored technique called "rack of eye." It takes the eyes of master craftsmen like Jamie and Houston Lewis to see that a boat has the right dimensions and design, says Roger Allen, curator of boatbuilding technology at the N.C. Maritime Museum in Beaufort. "Generally, if it looks right to an experienced eye, it will be right in the water," he says.

For wooden workboats used by shrimpers and fishers, the Lewis family uses the Harkers Island or Carolina design, recognized along the East Coast for its wooden hull and flared bow.

"When we first started, all of our boats were workboats for people in the boating community," says Houston Lewis, who carves decoys as a hobby. "Now, fishermen are struggling. We hardly ever build fishing boats. We build more pleasure boats."

The pleasure boats are usually sportfishing vessels, also called "sports-

Shipshape

Harkers Island Boatbuilders Keep Tradition Alive

By Ann Green

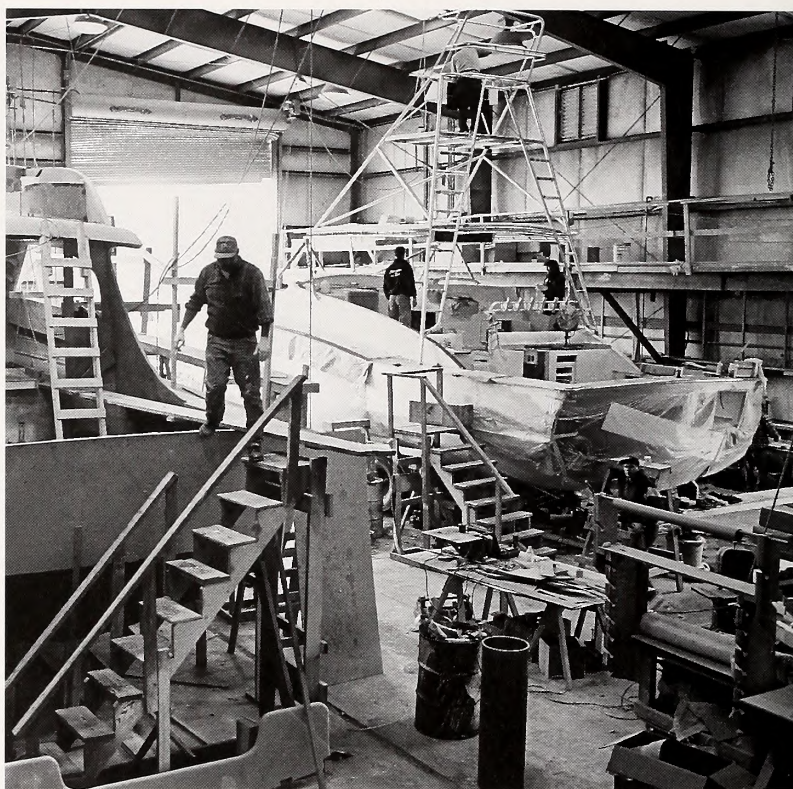
"Building boats is a craft," says Jamie Lewis, who has been building boats for more than 40 years. "Not everybody can do it. You have to have in mind what you want to do. I don't use blueprints. For big boats, we sketch something out."

fishermen." The boats are made out of juniper wood and coated with fiberglass on the sides and bottom. "Fiberglass seals the boat better, but it requires more work," says Houston Lewis. "You have to do a lot of hand sanding and rubbing to make it sleek and shiny."

Continued



Julian Guthrie is a boatbuilding legend.



East Bay Boat Works specializes in sportfishing boats and small yachts.

Lewis Brothers is one of three full-time boatbuilding businesses left on Harkers Island, a small community 20 miles east of Beaufort. Dozens of other islanders build their own boats in their back yards. "There are a lot of people on the island who can build boats but are doing something else to make a living," says Jamie Lewis. "Down the road on the other side of the gray house, a man is building a 55-foot shrimp trawler in his back yard."

Their metal boat shed is cluttered with tools, rusted paint cans, a mounted squirrel, a plastic duck decoy and pieces of juniper, also called soft juniper or cedar. Phil Lewis, a cousin, pounds a nail into a wooden skiff while Jamie, Houston and James swap boatbuilding stories during a coffee break.

"I've been helping my cousin at night," says Jamie Lewis, who built his first boat — a 17-foot flounder boat — when he was 17.

Jamie also passes on his secrets of the trade to his son, who joined the business

after high school. "I never took a carpentry class," says James Lewis. "I just learned from my father and uncle. It is all I grew up around. Now, my 7-year-old son is helping us paint boats in the summer."

Outside the garage, a handful of boats fill the yard, including an old wooden workboat built in the 1970s by Burgess Lewis, Jamie and Houston's father. "This is a regular Harkers Island boat with a round stern," says Houston Lewis. "Several years ago, we reworked it with fiberglass."

Although they don't keep records on their boats, Jamie Lewis estimates they have built between 100 and 200 work and sportfishing boats.

They charge an hourly rate, and the customer furnishes the materials. "Just make a living," says Jamie Lewis. "Just make a week's work like someone on a regular job."

The Lewis family lives near the boat shed on Harkers Island, which was bought by Ebenezer Harker in 1730. Many residents from the Shackleford Banks whaling community of Diamond City

moved to Harkers Island after their village was hit by a hurricane in 1899. These skilled whalers brought with them a vast knowledge of boatbuilding techniques.

Brady Lewis — no relation to Houston and Jamie — was considered the island patriarch of boatbuilding. Developer of the Harkers Island style, Brady Lewis taught the craft to Julian Guthrie, who in turn became a legend in the business.

Guthrie, 84, is retired from the business. At age 10, he built his first sailboat out of rot-resistant juniper and oak found in the nearby maritime forest.

For more than 25 years, he owned Hi-Tide Boatworks in Williston where he built a variety of boats — from sailing skiffs to luxury yachts. His customers came from as far away as Maine and Florida.

Guthrie, who stopped building boats when he suffered a stroke, often used his ingenuity in design. In 1982, he built a 65-foot yacht around a piano. He also constructed three-masted sharpie schooners and a ferry that still runs from Davis to Core Banks.



Scott D. Taylor

At Lewis Brothers on Harkers Island, sportfishing vessels have a shiny, sleek finish.

"Daddy was real diversified," says Eddie Guthrie, Julian's son. "He was always willing to try new techniques and designs. The crown jewel of his work was the *Allison*, a 72-foot custom sportfishing boat that cost \$1.5 million in 1981."

Over the years, Guthrie has received numerous awards, including the first Living Treasure of North Carolina Award from the University of North Carolina at Wilmington in 1988 and the prestigious N.C. Arts Council Folk Heritage Award in 1993.

"Julian Guthrie is important for the boatbuilding tradition in North Carolina," says Allen. "He went from being a lone boatbuilder in a one-man boat shop to being a creative force behind a crew that built and exported luxury yachts."

While Guthrie's business was thriving, other Harkers Island residents learned the trade.

Alex Willis, who has a full-time boatbuilding business on Harkers Island, learned the craft from his father. "Dad had a boat shed three times as big as mine," he

says. "When I was 11, I began helping him on weekends and evenings in the back yard of our house."

Willis, the grandson of patriarch Brady Lewis, thinks you have to be "born up in boatbuilding" to master the craft. "You can't teach someone who is 30 or 35 about boatbuilding," he says. "It's not like building a house. Nothing is square. Every frame is cut differently."

His first boat was the *Joyce Moore*, an 80-foot shrimp trawler built with his father. Later, Willis began specializing in sportfishing boats that sell for \$300,000 to \$325,000 to customers as far away as Alaska.

Now, he is working on a 42-foot sportfishing boat in his blue and white garage, which smells like fresh cedar. Piles of sawdust cover the floor around the boat. An array of tools is scattered about, including an old handsaw used by his grandfather.

Willis employs two other men in his shop. Over the years, he has had trouble getting help. "I look at it as a dying trade,"

he says. "The younger generation doesn't want to do it. It is too much work for them. I have young boys work with me and quit in a week or two."

About a mile from Willis' boat shop on East Bay, Ricky Gillikin runs the largest and most modern boatbuilding business on the island. At East Bay Boat Works, which consists of three building sheds, 20 employees custom-build sportfishing boats and small yachts.

Gillikin has merged traditional boatbuilding with modern techniques. "We combine the best of both worlds by using wood and fiberglass," he says. "However, my brother James still uses juniper on his sportfishing vessels."

When a customer orders a boat, Gillikin draws the design on paper. Then he makes a one-of-a-kind mold from triple layers of laminated wood and fiberglass with high-tech fabrics. "The hull is built upside down," he says. "Then we pull the boat out and flip her over."

In one of the East Bay boat sheds, a

Continued



Scott D. Taylor

When crafting a sportfishing vessel, Alex Willis carefully measures each piece of wood.

sportfishing convertible with a half tower takes shape. Next to it is a 50-foot express boat being built for a New Jersey man.

Inside the sportfishing boat, employees hand rub the walls and cabinets in the stateroom with Murphy's Oil Soap. The boat, which will sleep up to six people, will be equipped with a television and other modern conveniences. "This boat will be real fancy and like a home," says Gillikin. "It's all custom-built. The owner will be taking it to fishing tournaments."

Since the vessels are so large and custom-made, it takes from 12 to 18 months to build one. "So much thinking

and planning goes into a boat," says Gillikin. "Sometimes, we put 15,000 man-hours on a boat. Now we can work on up to four boats at one time."

Because of the labor required, the boats are quite expensive. "These boats are a rich man's toy," he says. "Our boats can go for up to a \$1 million. We sell to people who want a fast boat that will help them raise big fish and come in fast from shore."

East Bay Boat Works was started in 1971 by Ricky Gillikin's father, Vance, and his partner Mervin Rose. Later, Ricky Gillikin and his brother bought the business. They started out making river and head boats from juniper. In

1986, the Gillikins expanded into sportfishing boats and luxury yachts.

"The boatbuilding business was dying out in the 1980s," says Gillikin. "It was more feasible to build sportfishing boats and small yachts. So we diversified. Traditional wooden boats are not as strong and are slower than our boats."

Like the other boatbuilders on Harkers Island, Gillikin sells his boats by word of mouth instead of advertising. "We strive to put out a good product. Our boats are faster than a lot of boats built by major manufacturers and burn less fuel because they are lighter boats. Every boat is one of a kind." ■

Built in North Carolina

By Ann Green

If you are in the market for a luxury pleasure boat, you can likely find a North Carolina-made vessel to fit your needs — or your dreams.

"The boatbuilding industry is a growing economy in North Carolina," says Mike Bradley, director of N.C. Marine Trade Services.

"In the last few years, we've had the greatest expansion of boatbuilding production and new boatbuilders in North Carolina."

Today, there are more than 75 boatbuilders in North Carolina constructing a variety of recreational vessels — from small skiffs and kayaks to luxury yachts.

Last fall, Tiara Yachts, a division of S2 Yachts Inc. in Holland, Mich., opened a facility in Swansboro to make the 5000 Express, a 50-foot cruising yacht with a base price of \$830,000.

David Slikkers, president of Tiara Yachts, says the company came to Swansboro because of the experienced work force in the area. "We are very labor intensive and needed a talented work force," says Slikkers. "We also got a lot of support from Swansboro, Onslow County and state officials."

The company now employs about 50 people. "Over the next 24 to 36 months, we expect to expand up to 200 employees," he says. "We hope to add one new model a year to our product line in Swansboro."

Another boating manufacturer new to North Carolina is World Class Catamarans.

About 18 months ago, the company opened a facility in Greenville to manufacture power catamaran fishing boats retailing from \$55,000 to \$75,000. "We've had phenomenal growth," says Forrest Munden, company chairman. "The first year we sold out of all three models. Last year, sales were

As a result of the increased demand for boats, the value of boatbuilding and repair shipments in North Carolina jumped from \$227.7 million in 1993-1994 to \$275.1 million in 1995-1996, according to the U.S. Department of Commerce's Annual Survey of Manufac-

turers. In addition, the number of people employed in boatbuilding in North Carolina has swelled to 20,000, says Bradley.

Hatteras Yachts, the largest boat manufacturer in the state, has about 850 employees. The company makes more than 20 models of sportfishing

convertible and cruising yachts that cost \$1 million to \$7 million.

Grady White, which manufactures sportfishing boats that range in price from \$14,500 to \$101,000, employs about 400 people at its Greenville facility.

A few miles away in Washington, 300 employees at Fountain Powerboats make high-performance pleasure boats that retail from \$50,000 to \$1.5 million. The boats are used for offshore racing, sportfishing and cruising.

With the quality of the work force in North Carolina and easy access to water along the coast, Bradley sees a bright future for the state's boatbuilding industry. "Within the next two years, we expect to have 500 new jobs in boatbuilding and boat repairs," he says. ■



Courtesy of World Class Catamarans

World Class Catamarans will expand its North Carolina operation.

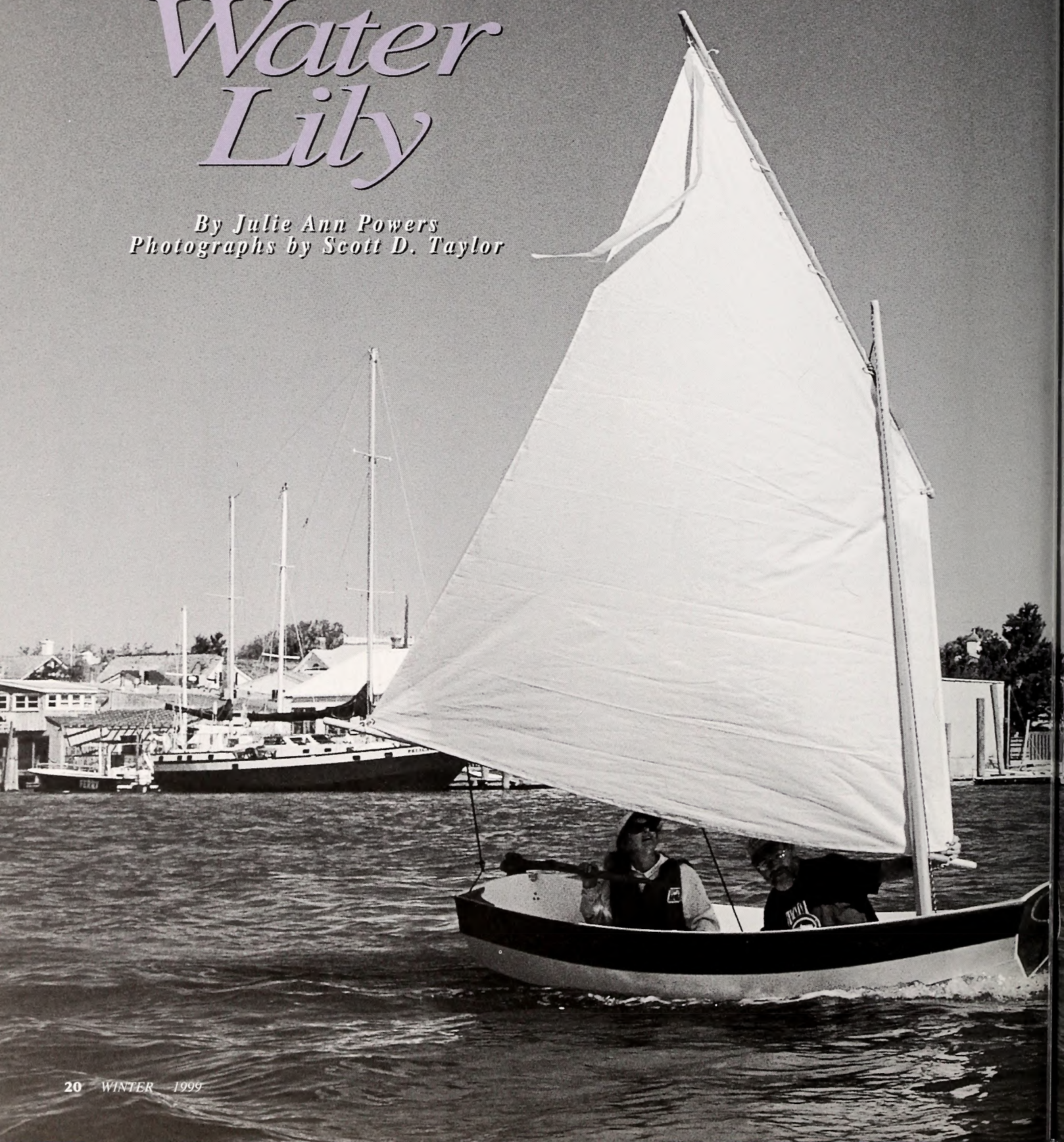
higher than projected by 100 percent."

In fact, World Class Catamarans is expanding so fast the company now has a new 121,000-square-foot facility in Tarboro. "The good economy is helping our business," says Munden. "Currently, we employ 125 people. With our expansion, we hope to employ an additional 200 people over the next 24 months."

In 1993, the repeal of the federal luxury tax — a 10 percent tax on luxury items more than \$100,000 — allowed boating manufacturers to recover from a near-fatal sales level, says Bryant Phillips, senior vice president of sales and marketing for Hatteras Yachts in New Bern. "With the strength of the economy and rise of the stock market — coupled with new models — Hatteras Yachts is coming on strong," says Phillips.

The Launching of the *Water Lily*

*By Julie Ann Powers
Photographs by Scott D. Taylor*



Building a boat requires logic, precision and three-dimensional visualization. It requires concentration, commitment and perseverance. It requires sharp instruments, power tools and manual labor.

In other words, building a boat is contrary to my character, my experience and my philosophy opposing hard work. Yet I, who have never built so much as a birdhouse before, whose creativity has been confined to the printed page, I will build a boat.

Thanks to the N.C. Maritime Museum's Harvey W. Smith Watercraft Center, I will build a beautiful little wooden boat. I will name it *Water Lily*. It will be a pleasure to look at and a joy to sail.

For me to build this boat is a minor miracle. It is an unparalleled adventure in learning. It is a total immersion in a cedar-scented traditional boat shop. And it is an unforgettable experience hard to come by in these high-tech times.

Fortunately, some people, such as those at the watercraft center, still consider the knowledge worth preserving and wooden boats worth building.

The watercraft center conducts a range of traditional boatbuilding courses, including the class that results in *Water Lily*. Wooden boat designs important to North Carolina's maritime history also are built or restored in the cavernous quarters overlooking Front Street and Taylors Creek.

Roger Allen is my instructor, mentor and cheerleader in building *Water Lily*. Allen has been curator of boatbuilding technology at the watercraft center since it opened in 1992. He started working with wooden boats in Philadelphia on the 1887 ship *Gazella Primiero*, a 157-foot Portuguese barkentine. He came to Beaufort from the Philadelphia Maritime Museum.

Although Allen has had a hand in building 250 or so boats, he seems

delighted as I watch mine emerge from the pile of plywood and puffs of sawdust. He is a patient, good-humored and open-minded teacher. The only thing he insists I do his way is to fold a half-sheet of sandpaper into thirds. His unstated requisites: Enjoy your work. Be good to your tools.

It is Allen who convinces me that I can, in fact should, build this boat. I am enchanted with sailing small boats. I particularly admire the Nutshell Pram design, a cheerful-looking rowing and sailing dinghy often used as a yacht tender. Its lines curve up at both bow and stern, like a lopsided grin. It rocks lightly on the water when idle, as if it can't wait to go sailing.

The Nutshell is the creation of Joel White, who died in 1997, much to the sorrow of the traditional boat community. White is known for the elegant simplicity of his designs and his advocacy of wooden boats. The Nutshell is among his most

C o n t i n u e d



well-known works. *WoodenBoat* magazine has sold more than 1,500 sets of plans for it, in the 9-foot-6-inch version, which I build, and also in the 7-foot-7-inch length.

To buy one of these vessels already built is beyond the tax bracket of a free-lance writer. To build one myself is a preposterous proposal until a casual conversation with Allen takes a momentous turn. The Nutshell is his favorite design for the boatbuilding courses. We talk about its superb qualities.

"Take the course and build one," he says. I scoff. He insists. I point out my past is devoid of woodworking and I am inept with tools. He shrugs and says it doesn't matter. I argue I would make a mess of measuring because I am mathematically dyslexic.

"Boatbuilders hate math," he says. That does it. I sign up.

I have another motive besides the boat. I long for tool literacy and the self-sufficiency it promises. Most students do not have this tool deprivation syndrome. Though I am not the first female, enrollees are generally men who know their way around a shop.

Allen assures me even housebuilders have no advantage when it comes to boatbuilding. Building a boat is not like building anything else. Boats are all curves and angles.

Still, I feel ill-equipped even after two preparatory courses. I hope the four other students will pick up the slack. Only one, however, shows up. He is committed to building a canoe.

I am alone with the would-be *Water Lily*. Well, not really. Allen is beside me much of the time, explaining the next step and what it means to the boat.

In boatbuilder terms, the Nutshell is of lapstrake construction. That means its planks overlap. The technique dates to the Vikings and is capitalized on with modern



Staff and volunteers at the watercraft center share knowledge and praise as Powers brings Water Lily to life.

materials in the Nutshell. The seams are fortified with epoxy. The hull is marine-grade mahogany plywood — tough, lightweight and water-resistant.

The Nutshell is a pram. Its hull planks join a transom at the bow instead of tapering to a point. The squared-off style is distinctive. Someone says my boat is a twin to the wooden shoe Wynken, Blynken and Nod sail in the nursery rhyme. I take it as a compliment.

Besides offering a look I like, the pram bow gives the boat a large capacity for the length, and it's easier to build than a pointy one.

Of course, "easier" is a relative concept in boatbuilding. I am overwhelmed with unfamiliar terms and tools the first days. Even the directions are foreign to my ways. I prefer printed text as a means of instruction. Here, I have only

drawings and patterns to tell me what to do and Allen's demonstrations to learn how.

Mostly, my mission is to pursue complete — and elusive — compatibility among the boat's many parts. I saw, plane, bevel, chisel and sand, seeking harmony wherever two surfaces meet.

I am awkward with the hand tools, timid with the power saws. I cringe at the potential for disaster as I drill holes for bronze screws. Progress is maddeningly slow, made even more so by mistakes. I must cut a new bow transom when the first mysteriously turns out asymmetrical. The forekeel gets stuck to the mold when I am too liberal with epoxy. I also epoxy some of my hair. It seems I spend half my time correcting errors. Allen assures me this is normal.

"Boatbuilding is problem-solving," he says whenever I am frustrated. It is a triumph when I suspect the keel's curve isn't quite true before I cut it and find a misread fraction in the

dimensions. I realize I am solving — and avoiding — problems. I am flattered when Allen says I am thinking like a boatbuilder.

In fact, I hardly think of anything except boatbuilding. I don't open mail. I don't return calls. Friends wonder if I have gone to sea. Not quite, but I am in a different world. Dozens of tourists who pause, enthralled, at the big front doors every day remind me just how extraordinary my environment is.

"Look," I hear over and over again. "They build boats here!"

It is a bit unnerving at first to work in such a public place, but I am soon too engrossed to notice the flashbulbs. In a pleasant way, the building of my little boat seems everybody's business. Wood in the shape of a boat has an irresistible magnetic effect on the human hand and eye. *Water Lily* develops a following of local self-

described “boat groupies.” I often look up to find someone caressing the laminated sassafras frame or the sanded cedar seats.

Water Lily shares the construction floor with a 28-foot-9-inch sharpie, a historic design being built by watercraft center volunteers.

Generous with time and talents, many in this

laudable squadron contribute much to *Water Lily*. Not only do they help me with countless tasks, they share their doughnuts at break time.

It is a friendly and fun place. Allen, the other student and I make up a silly little song about lamination — gluing thin strips of wood together for frames. We sing it often.

The course runs for 16 days in a row — not enough time for one slow student. But thanks to help from Allen, shop technician William Prentice, volunteers and friends, most major construction is done. It’s good I don’t know how much work is still ahead.

It takes the better part of six more weeks to bring *Water Lily* to launching. Despite growing competence and confidence, there are trying times.

“The devil is in the details,” Allen says. I am bedeviled. It seems I have miles of edges to shape and acres of surface area to prep and sand. And sand. And sand. My significant other takes pity and pitches in. Still, my hands ache, my sinuses swell and my spirit wilts in the sanding dust.

Finally, it is time to trade the sandpaper for paint rollers. I get my first glimpse of the boat I have envisioned — green and white, with varnished transoms and trim. I am ecstatic.

The painting epiphany invigorates me for the last hectic days. We plan to launch



Patience is the key to finding the exact fit for the forward quarter knee.

the boat at the annual in-water meeting of the Traditional Small Craft Association, a group of wooden boat fans affiliated with the Friends of the Museum.

Water Lily isn’t done until 6 p.m. on the eve of the meet. “Done” is another relative concept in boatbuilding. There are minor matters to tend to, but she is ready to be launched. We put up the mast and hang the rudder as she sits on sawhorses in the shop. Then we hoist the sail — sewn in another watercraft center class — and stand back for the first look.

The effect is stunning. Allen shakes my hand. I shake my head in disbelief.

The next day on the shores of Bogue Sound, the bright new boat sparkles in the sunshine. Admirers gather. *Water Lily* is bound to be the belle of the ball. The builder matches the boat. I have dried paint on my knees and varnish on my ankle.

I worry the audience will pick out the imperfections such as the ill-fitting cleat I fashion at the last minute. But it isn’t that kind of crowd. These people know what it takes to build a boat. They heap on praise. They also understand my seeming lack of humility. They know it is awe, not arrogance, that makes me agree with all compliments.

The boat launching is a joyful occasion. There is much applause as I pour a bottle of Perrier over her bow, christen

her *Water Lily* and ask the sea gods to be kind.

I invite Allen to join me for the first sail, and we set off past the moored fleet of grand wooden sharpies and spritsail skiffs. It is a sweet, sweet moment when *Water Lily* meets her elements of water and wind for the first time. She proves she is not just a pretty face. She sails gloriously.

Back at the dock, a line forms for a turn

at the tiller. I try to be magnanimous. But I surreptitiously check credentials: “Is he a good sailor?” I ask in low tones as the next person casts off.

Finally, I decide *Water Lily* is meant to be on the water, not on display. However lovely, she is a boat, not a piece of fragile art.

I take good care of *Water Lily* but let her be a boat. She does the not-so-glorious things boats do. She goes aground. She goes adrift. She capsizes.

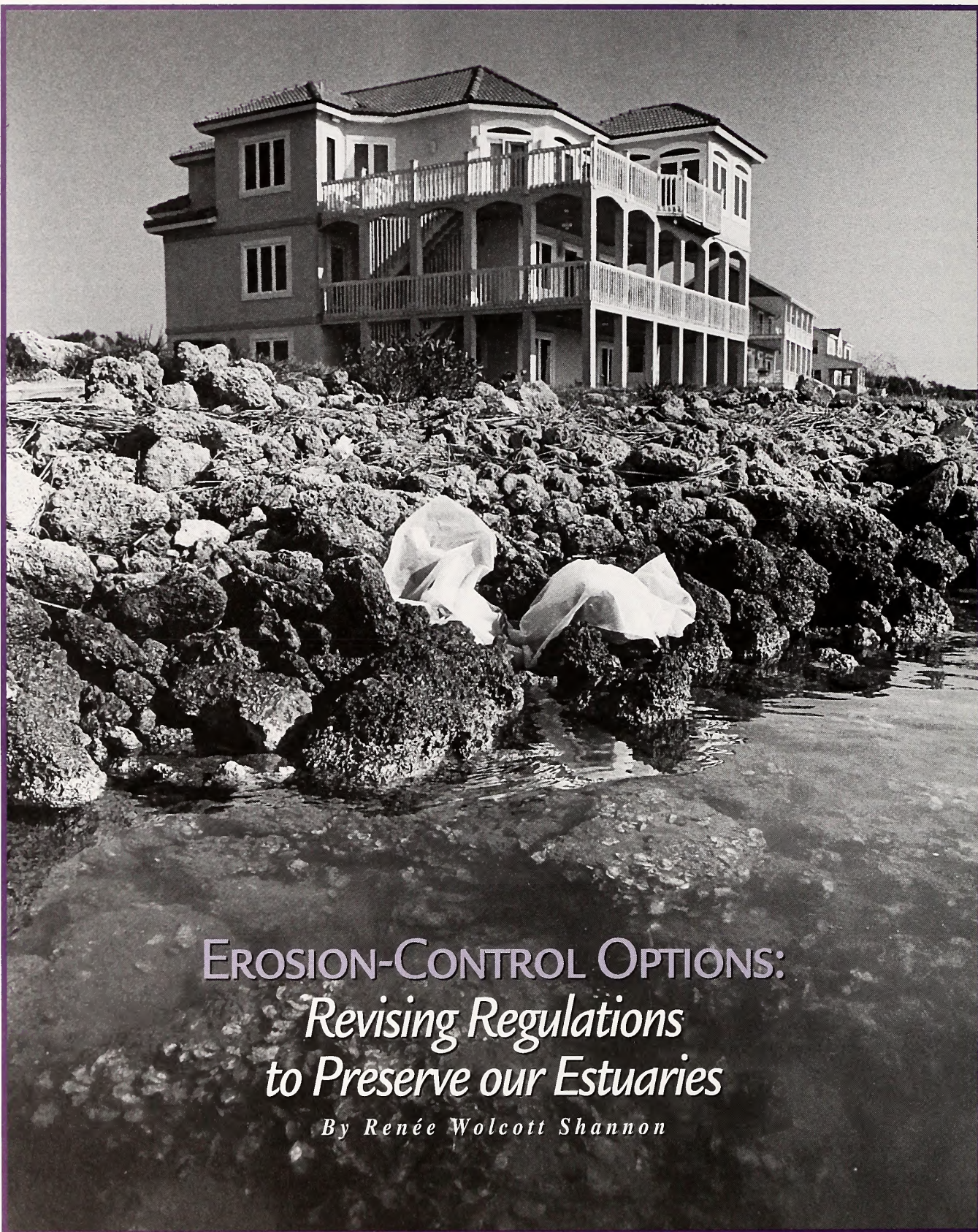
Though I might curse when her daggerboard finds an oyster shell or her varnished guardrails scrape a dock, I don’t despair over these perils. I can fix or make new whatever gets damaged, broken or lost. I can build another boat.

I’m a boatbuilder now. ■

The lapstrake boatbuilding course is one of several classes offered by the Harvey W. Smith Watercraft Center. Tuition is \$340.

Boatbuilding carpentry is a required prerequisite; the lofting course to transfer scale drawings into full-size patterns is recommended. Both are two-day courses on weekends. Tuition for the carpentry course is \$90; lofting tuition is \$60. Friends of the Museum receive tuition discounts.

For a full schedule, contact the N.C. Maritime Museum, 315 Front St., Beaufort, NC 28516 or phone 252/728-7317.



EROSION-CONTROL OPTIONS:
*Revising Regulations
to Preserve our Estuaries*

By Renée Wolcott Shannon

RIPRAP REVETMENTS, LIKE THIS ONE ON TAYLOR CREEK IN BEAUFORT,
MAY BECOME EASIER TO INSTALL UNDER REVISED REGULATIONS

Courtesy of the Raleigh News & Observer

THERE'S A BEAUTIFUL HOME on the Pasquotank River — a long, low ranch half-hidden by trees. Walls of windows blink from the cool shade. A green lawn punctuated by exclamation points of pampas grass slopes to the water, where the wakes of passing boats lap against a wooden bulkhead.

Homesites like this one were less common 20 years ago, when few people lived near the estuaries. But in the last two decades, the shores of North Carolina's estuaries have seen a population and building boom that has sprinkled the shorelines with homes, businesses and docks.

This rapid development has state regulators reconsidering the policies that shape construction along our estuaries. With more people living, farming and building on North Carolina's 4,000 miles of estuarine shoreline, water quality and environmental conservation in the estuaries have become a pressing concern for the N.C. Coastal Resources Commission and the Division of Coastal Management.

PROTECTING WATERFRONT PROPERTY

On the estuaries, erosion is a constant problem. Wind, waves and boat wakes eat away at exposed shorelines, aided by the slow rise of sea level. To protect their land, property owners often apply for permits to build shoreline stabilization structures at the water's edge.

In North Carolina, vertical wooden bulkheads traditionally have been the most popular way to protect valuable waterfront property. Riprap revetments,



FAIRFIELD HARBOR, BUILT BEFORE THE COASTAL AREA MANAGEMENT ACT, DEMONSTRATES HOW BULKHEADS CAN PROFOUNDLY CHANGE THE ESTUARINE ENVIRONMENT.

which use large boulders to stabilize a graded bank, are another option. Even for those without erosion concerns, hardened shorelines can provide level ground to anchor a pier or establish flat lawns.

Under current regulations, property owners can get general permits for bulkheads and other erosion-control structures along estuaries as long as the Division of Coastal Management approves the structure's location. General permits incorporate certain restrictions: Bulkheads must be landward of coastal wetlands or submerged aquatic vegetation, and property owners usually can extend bulkheads no more than two feet past the mean high water line. Special exceptions allow property owners to extend bulkheads farther to reclaim any land they have lost in the past year, which can be a significant amount after hurricanes like Fran or Bonnie.

Since a bulkhead requires only a general permit, property owners can often set up a site inspection with a division field representative and get a permit the same day. Those who don't have erosion problems can still build because of an exemption allowing bulkheads above the mean high water line. Since 1978, when it began issuing Coastal Area Management Act (CAMA) permits, the Division of Coastal Management reports that it has

issued permits for more than 200 miles of bulkhead — enough to stretch from Raleigh to Manteo.

Other erosion-control options, such as certain riprap revetments and marsh grading and planting projects, have been harder to obtain. While general permit applications for bulkheads cost \$50 and are often granted in a day, the major permit applications for revetments and other alternatives cost \$250 and

take anywhere from 75 to 150 days to process.

The general permit is an "expedited form of the major permit," says Alison Davis, public information officer for the Division of Coastal Management. "They apply to cases where the environmental effects of construction are already known and considered to be minor."

Major permits, like those for revetments below the mean high water line, take longer to process because they must circulate through 10 state and four federal agencies for comment. "Those agencies might have concerns about the project that the division isn't aware of," says Davis.

REVISING THE REGULATIONS

Growing public concern about estuarine water quality and habitat loss has now prompted the Coastal Resources Commission to review the regulations governing construction on the estuaries. The review process is lengthy and open to the public through hearings in each of the 20 CAMA counties; any revised regulations would not go into effect until the year 2000.

The proposed changes would increase the setbacks for building along the estuaries,

Continued

decrease the amount of impervious or built-upon area allowed on waterside property and establish buffers along the estuarine shoreline, as well as set different standards for erosion control permits.

"People said, 'Why do we have this no-hardening rule on the oceanfront but not in the estuaries?'" says Bill Crowell, cumulative impacts analyst for the Division of Coastal Management.

Oceanfront stabilization has been prohibited since the late 1970s, when concern over beach erosion prompted the Coastal Resources Commission to write regulations banning the armoring of waterfront properties. Rigid structures that extend into the water trap sand from the longshore current and prevent it from settling out on the properties immediately "downstream," starving them of sand.

Water hitting bulkheads or seawalls can also promote erosion during storms, since the force of waves is transferred downward and to either side of the structure. Over time, the dry sand beach at the toe of a bulkhead is eroded away. Hardened shorelines also prevent the natural inland and southward migration of beaches that allows the Outer Banks to strike their dynamic equilibrium with the sea.

Now the Coastal Resources Commission is taking a long, hard look at shorelines in the estuaries. While oceanfront regulations are meant to preserve beaches for public recreation, regulations for the estuaries seek to preserve critical marshes and intertidal areas that are the foundations of coastal water quality and estuarine food chains. Here, where fresh and salt water mix, marsh grasses and an undulating shoreline create a safe haven for juvenile species such as blue crabs, shrimp and striped bass. Ninety percent of commercial fishing species and 65 percent of recreational species spend some part of their lives in estuaries, seeking shelter from predators as they grow to maturity.



MARSHES AND INTERTIDAL AREAS ARE
A CRITICAL HABITAT FOR MANY JUVENILE SPECIES.

Marshes also absorb pollutants from runoff and dampen the force of incoming waves, lessening erosion. If shoreline stabilization results in the loss of these marshes, estuarine water quality declines and many species lose a crucial habitat.

The proposed rules seek to preserve fringing marshes as much as possible and to avoid the negative effects hardened shorelines can produce. The proposed rules from the Coastal Resources Commission would establish a hierarchy of erosion-control methods that ranks alternative methods above the more traditional bulkheading. "We're trying to tailor shoreline stabilization methods to particular sites using a tiered approach," Davis says.

Under the proposed rules, Division of Coastal Management field representatives would visit sites to determine the erosion-control method most compatible with the location. Those with no erosion problems would be prohibited from building hard structures. For remaining sites, representatives would inspect the landforms and water characteristics at the site, including wave energy and fetch. Fetch refers to the distance waves can travel and build in size before reaching the shoreline.

In sites with sloping shorelines, existing marshes or limited fetch, property owners would be encouraged to plant marsh grasses or cultivate the existing marsh to anchor the shoreline and to dampen the force of incoming waves. Areas with higher wave energy or steeper shorelines might

require breakwaters or stone in addition to the marsh grasses, or riprap revetments along a graded bank. "We've proposed a new general permit for riprap to make it easier to install," Davis says.

Vertical walls would only be permitted in existing narrow canals or locations where marsh plantings or sloping structures would not be practical for erosion control.

EROSION-CONTROL OPTIONS

Rigid structures in estuaries can have negative effects. Like their oceanfront counterparts, estuarine bulkheads promote scour at the toe of the structure and increase erosion of the unprotected land to either side. They also reduce habitat for juvenile animals that come to the estuaries to mature. A 1995 study in Lake Conroe, Texas, found far fewer juvenile and adult fish in front of bulkheads than in front of sloping riprap revetments. Riprap structures, which have cracks and crevices between rocks instead of a smooth surface, provide a better habitat for animals but prevent marshes from migrating inland just as bulkheads do. Marsh grasses waterward of any rigid structures are likely to be drowned. The treated wood used to build bulkheads also can transfer arsenic and other toxic chemicals to the environment.

Despite these shortcomings, rigid structures and bulkheads in particular are sometimes the best option for certain shorelines. Spencer Rogers, coastal construction and erosion specialist for North Carolina Sea Grant, believes the environmental impact of erosion-control structures is largely determined by their distance from the water.

"The toe of the structure should be as far landward as possible to minimize its impact," says Rogers. "Sloping structures or revetments must be wide to function properly, but narrow vertical structures such as bulkheads can be readily moved

farther landward." If property owners installed bulkheads farther from the water, they would decrease the environmental impact on the estuary.

Tracy Skrabal, a scientist with the North Carolina Coastal Federation, disagrees with Rogers' approach, though she admits rigid structures would have less environmental impact if property owners moved them landward. "That works great in theory," she says. "But nobody is willing to do that in practice. Most people put bulkheads out as far as they are allowed and fill in behind them."

The Coastal Federation is a nonprofit environmental advocacy group that urges developers to build as far from the shoreline as possible so that the natural inland migration of wetlands can continue. Where homes already exist close to the water's edge, the Coastal Federation promotes marsh-grass planting as the optimal method for shoreline stabilization.

Skrabal heads the Shorekeeper Project, which restores shorelines through grading, planting marsh grasses and stabilizing with limited amounts of rock, if necessary. Volunteers do all the work in the yards of participating homeowners.

The Coastal Federation hopes its marsh-planting efforts will demonstrate alternative strategies to property owners, restore estuarine habitat, stop erosion and ensure better water quality along the coast. Since planting marsh grass does not require a permit (though grading and adding riprap would), planting marshes or cultivating existing wetlands costs property owners more effort than money. Individual plants cost 40 cents and are spaced 18 inches apart, making planting marshes more economical than vertical walls or revetments, which may cost \$50 to \$100 per linear foot.

Still, marsh grasses alone are not enough to stabilize many estuarine shorelines. Rogers has helped to develop a low-cost erosion-control alternative that



PLANTING MARSH GRASS DECREASES EROSION
ALONG LOW-ENERGY SHORELINES.

makes use of marsh vegetation in combination with vertical wooden breakwaters or riprap sills. "They can be made to work almost anywhere in the North Carolina estuaries," Rogers says. "Existing installations extend from Intracoastal Waterway sites in Brunswick County to brackish water in Currituck Sound to a 40-mile fetch across Pamlico Sound in Frisco."

In this method, a simple breakwater is placed waterward of the mid-tide line to protect marsh-grass plantings closer to land. The low-profile breakwater dampens wave energy and keeps marshes from eroding. The dense root-mat formed by marsh vegetation further decreases wave energy and prevents erosion at the shore. Property owners can help the process by carefully transplanting and fertilizing the grasses.

LOOKING TO THE FUTURE

Chuck Bissette, a contractor with T.D. Eure Construction Co. in Beaufort, says that property owners are willing to use alternatives to bulkheads once they know they are available, especially since the cost is often lower. Still, bulkheads have a certain aesthetic appeal to many homeowners.

"You can establish a definitive property line with a bulkhead, which is hard to do with a riprap revetment," Bissette says. And if there is a beach

beyond the erosion-control structure, homeowners can climb over a bulkhead much easier than over the large boulders of a riprap revetment.

Developers acknowledge that the proposed regulations have the potential to be a huge issue. "Bigger than the ban on coastal hardening," Bissette says, "because estuaries have more parcels of land and more individual property owners. If there were a ban on bulkheading, the wood-treating lobby, timber

council, vinyl and aluminum suppliers — all of them would pitch a fit." But for now, Bissette remains unconcerned about the proposed changes. "I haven't seen the teeth in it," he says.

"The new regulations are not a big change from the rules already in effect," agrees Crowell of the Division of Coastal Management. "They just spell the rules out. We prefer sloping structures to vertical bulkheads. We are not proposing a ban, only appropriate use."

At any rate, the regulations are far from finished. The Coastal Resources Commission will continue to solicit comments from the public, and the drafted regulations will be publicized at hearings in the 20 CAMA counties. The commission may then revise the rules in accordance with public response. The regulations will pass through a rules review committee before going to the North Carolina General Assembly for acceptance or rejection. The rules currently under debate won't go into effect until August 2000 at the earliest.

The public still has plenty of opportunities to get involved. Hearings will be posted in local newspapers, and Coastal Resources Commission meetings are open to the public. "Rules get updated all the time, as people learn about the environment and the physical processes that affect it," Crowell says. "Twenty years of development along the estuaries reveal some environmental threats. We're trying to encourage appropriate use of our resources." ■

All Good Things

By David Cecelski

When I began writing "A Historian's Coast" three years ago, I never expected to do so much research in a boat. The tools of a historian's trade are usually found in old books and archives, not in a coastal swamp or tidal creek.

But early on, I learned that I had to get out and see a place if I really wanted to understand its past. Even our wildest swamps have a natural history — sometimes gradual, other times cataclysmic — that has been influenced by settlement, exploitation and other human practices. Most of this past has never been written down and is often not apparent, but you can find traces of it in the land itself if you spend the time and look closely.

This is the last of my short essays for *Coastwatch*. I've been writing "A Historian's Coast" since January 1996 and, regrettably, I can no longer fit the extra half dozen deadlines a year into my life. In this, my swan song in these pages, I'd like to discuss some of the ways that the places I've been in my canoe and kayak have opened up our coastal history for me.

I probably would feature many of these places in future essays if I could keep writing for *Coastwatch*. They all helped me to visualize the coastal landscape at different points in our past and to see a reflection of ourselves in the ways that we've left our mark on the land.



Richard Cecelski examines a bald cypress on the Black River during a summer drought.

On many of my forays onto coastal waterways, I've been extremely fortunate to have my brother Richard Cecelski as a guide. Richard is the founder and director of Carolina Ocean Studies, an environmental education group that conducts wonderful field trips for schoolchildren from Carolina Beach and Beaufort. Richard is also one of the most expert swamp guides in all of North Carolina. He has an unusually good feel for our coastal swamps and tidewater creeks. It's been a privilege — as well as a lot of fun — to learn from him.

Richard has a keen eye for the human relics that one finds even in the most remote swamps. A tar pit indicates a site where naval stores had been produced, hence where a longleaf pine forest once stood. A tangle of narrow-gauge railroad track reveals that the swamp forest had been timbered, almost certainly during the period from 1880 to 1920. During those years, Northern timber companies that had already depleted the old-growth forests of New England and the Great Lakes swept through our coastal forests like locusts. And when we stumble upon a sunken shad boat on a creek off the Alligator River or a hand-hewn bow net hidden along the White Oak River, we know we've discovered traces of a springtime fishery that was the largest in the state in the late 19th century.

The canals that pass through coastal swamps also reveal a great deal about the past. Sometimes all you notice is a narrow, all-too-straight line of visibility through a cypress swamp, but you can bet it's an old canal once used to float white oak timbers, cypress shingles or cedar staves to a mill. Along intertidal marshes, I've inadvertently paddled into a labyrinth of intersecting, narrow canals, a sign of rice cultivation in the 18th or 19th centuries, when large gangs of slaves cultivated the "golden grain" along the Lower Cape Fear. I've also followed other, larger canals in places like

Lake Phelps and Lake Mattamuskeet that date to the late 18th and early 19th centuries, when slaves dug canals to drain swampland for agriculture and to raft goods to market.

In my travels, I've been to even larger canals, known as ships' canals, that bring to life the golden age of canal building in America between the American Revolution

Michael Halmuski



Michael Halmuski



Scott D. Taylor



and the Civil War. During that period, many political leaders believed that ships' canals held the greatest promise for overcoming the navigational hazards of North Carolina's shallow sounds and dangerous, shifting inlets. Between 1794 and 1805, for example, slaves dug the 22-mile-long Dismal Swamp Canal to serve as a shipping route between the Albemarle Sound and Chesapeake Bay and to skirt the dangerous swash and bar at Ocracoke Inlet.

Antiquated by the opening of the Albemarle and Chesapeake Canal in 1859, the Dismal Swamp Canal has had lasting consequences that have nothing to do with

shipping. The canal blocked the Great Dismal Swamp's natural flow from west to east, eventually drying up the vast wetlands east of the canal and opening them for agriculture. The canal also lowered water levels throughout the moister parts of the Great Dismal, drying out the highly combustible upper layers of peat during summer droughts. Even as early as 1860, unprecedentedly hot peat fires had burned much of the old-growth forests of cypress, juniper and gum in the Great Dismal.

Millponds also have a story to tell. Quite often, Richard and I stumble upon old millponds along remote blackwater creeks. We frequently discover relics of the mill's dam or foundation. Being on a millpond, I find it easier to imagine what much of our coastal landscape would have looked like in the period from the Revolutionary era well into the 20th century, when millponds could be found in

every coastal community. Local people dammed creeks and harnessed the water's flow to power sawmills as well as gristmills that provided flour and cornmeal.

I spent one of the best days of my life paddling in Merchants Millpond, formed late in the 18th century when a group of Gates County merchants dammed Lassiter Swamp.

Today it's part of a state park that rents canoes and campsites to the general public.

More often, though, I go to Morton's Millpond near my family's homeplace. I usually paddle north along the Harlowe and Clubfoot Creek Canal and arrive at the old millpond an hour or two before twilight. An osprey will still be fishing at that hour, and I'm likely to see wood ducks, herons and maybe a gallinule or two before they settle down for the night. The place is bursting with life: dragonflies and lightning bugs, fish hitting the water and often an otter or muskrat.

Continued

A HISTORIAN'S COAST

Millponds, like all wetlands, are an example of what ecologists refer to as an ecotone, a transition zone between two diverse ecological communities. Ecotones support life native to each of the two communities (woods and river, for instance), as well as plants and animals endemic only to the ecotone. The heightened diversity and density of life in these transition zones — known as the “edge effect” — is what makes millponds so remarkably rich in life.

That’s also true for beaver ponds. Beavers are a keystone species, with their dams creating entire ecosystems that provide habitat and food for a wide range of birds, fish, amphibians and other animals. Their ponds were once a ubiquitous part of the coastal landscape, filling tens of thousands of acres and providing a remarkable ecotone for all kinds of life. Exterminated by the colonial fur trade and farmers irate at flooded fields by 1800, beavers have only recently started making a comeback in many parts of Eastern North Carolina. I never saw them when I was a boy, but I’ll never forget the first beaver pond I saw, off Devil’s Gut between Williamston and Jamesville. Now I find there’s nothing nicer than hearing a beaver’s tail slap the water when I’m spending a night in a swamp.

Sometimes when I’m staying overnight in a coastal swamp, I get a glimpse of an even more distant past. It’s often not easy to find a dry campsite in a swamp forest. A few times I’ve had to paddle well into the night before finding a place to rest my head. More than once, on waking the next morning, I’ve discovered clusters of arrowheads and shards of pottery around my camp, letting me know that I was hardly the first person who found shelter on that knoll or hammock.

The coastal Algonquians — or their ancestors — clearly used these same places for fishing camps long before the 16th century. A little hammock along Bennett’s Creek in Chowan County is one place that comes right to mind.

For all my historical musings, my special fondness for coastal swamps has nothing to do with the past. Maybe it’s in

have had the chance to fall in love with the natural beauty and ecological uniqueness of these coastal wetlands — the cypress swamps, blackwater creeks, pocosins and Carolina bays.

Once covering more than 3 million acres, these coastal wetlands had been reduced to less than 500,000 acres by 1973. Vast wetlands like the Green

Swamp, once one of the largest swamplands in North America, have vanished. We’ve lost thousands more acres of wetlands in the last couple of decades, mainly due to timber companies. If these unsung wildernesses are going to be saved, it will have to happen soon.

I know that *Coastwatch*’s readers will be among the first to stand up for these coastal wetlands. I’ll miss writing for you all, and I’ll especially miss the cards and letters (and telephone calls to my mother), letting me know what you liked and didn’t like about this

or that essay. I appreciated them all and learned something from most of them.

I also enjoyed meeting many of you as I traveled around the coast. I couldn’t be more grateful for the hospitality. You gave me directions to hard-to-find spots. You fed me suppers of fish stew and fritters. Above all, I appreciate those of you who quietly took me aside and shared an ancestor’s diary or the location of old ruins that revealed new parts of our coastal past.

It’s great writing for readers like you. And if you haven’t met me yet, I hope we’ll meet soon. I’m the one in the small boat paddling into the swamp and, as always, into the past. ■

David Cecelski is a historian at the University of North Carolina-Chapel Hill’s Southern Oral History Program and has been a regular columnist for Coastwatch.



Richard Cecelski, left, Amber and David Cecelski cruise the Black River.

my blood. Though I didn’t spend much time as a youngster in the Lakes Pocosin, I did grow up on the edge of that swampy wilderness, which is part of the Croatan National Forest east of New Bern. Certainly we all got bitten by enough mosquitoes that we ought to have some of that pocosin in our blood. Maybe it’s because I’ve had so many good times poking around these blackwater rivers and swamps with Richard. Then, too, I know I find a solace and tranquility in them that often eludes me amidst the usual chaos of my life.

Above all, though, I am haunted by the fragility of these freshwater wetlands — our most endangered and under-appreciated coastal habitats. Everybody admires the beauty of ocean beaches and salt marshes, and I think most people appreciate their importance for tourism and the seafood industry. But far fewer people

Beautiful, Bountiful Bay Scallops

By Ann Green

With its gracefully flared shells and tiny, sapphire-blue eyes, the Atlantic bay scallop is a royal celebrity among mollusks. It also distinguishes itself from most bivalves by living at the bottom of dense beds of sea grass instead of burrowing into sand like a clam.

"Because the bay scallop lives in sea-grass beds, it can only be found in two Southeastern states — North Carolina and Florida," says Trish Murphy, a biologist with the N.C. Division of Marine Fisheries. "Florida doesn't allow the commercial harvest of bay scallops."

In North Carolina, the bay scallop or "ol' blue eyes" can be found in Core and Bogue sounds.

When fishing for bay scallops in North Carolina, people can hand-rake, scoop or drag a toothless scallop dredge through sea-grass beds from January to May. There is also a short season in December.

Although there has been no reported loss of sea grass in North Carolina, researchers have reported a decline due to pollution and disease in the Chesapeake Bay and other bodies of water. In North Carolina, there are two species of sea grass — eelgrass and shoal grass.

"Sea grass is an important nursery in North Carolina because it provides a habitat for young fish, shrimp, clams and molting blue crabs," says Murphy. "To protect sea grass, North Carolina has closed off all sea-grass beds to mechanical shellfish harvesting and some beds to trawling since the 1970s."

In 1997, North Carolina had the



Atlantic Bay Scallop

largest dockside landings of bay scallops along the East Coast, harvesting 63,800 pounds worth about \$214,000, according to the National Marine Fisheries Services. "Bay scallops are an important fishery for Carteret County," adds Murphy.

The tasty bay scallop also has a long history in the arts. Because of its graceful shell, Greeks and Romans memorialized the shell in one of their myths, the story of the birth of Venus. The goddess of love and beauty sprang full-grown from a scallop shell. Medieval and Renaissance artists and craftsmen also used the scallop shell over and over in their work.

In North Carolina, the scallop's shells can be found in and along the banks of Core and Bogue sounds. The shell, which is similar in shape and sculpturing to the Atlantic calico scallop, has 15 to 22 smooth radial ribs. It comes in shades of gray, brown and black, with the upper valve having the most color.

Inside its cover, the scallop has large, white adductor muscles that rapidly open and close its valves, ejecting water around the hinge. The adductor muscle is eaten by humans. Around the edge of the mantle — the layer of tissue that secretes the shell — is a series of 100 blue eyes that detect approaching predatory snails or starfish. After eyeing its predators, the bivalve snaps its shells and leaps away.

Like clams and other bivalve mollusks, bay scallops feed by filtering their food from the water. As they sit on the bottom of sea-grass beds, tiny hairs in their gills create a current that passes through the gills. The scallops extract the oxygen they need from the moving water and also filter out the phytoplankton and other minute plants. The current brings in some sand, but by shutting their shells, the scallops can expel the grit.

The bay scallop carries both male and female organs. Spawning takes place at about six months, when the scallop emits eggs and sperm into the water. For the first two weeks, the young are in a larval form, floating from place to place before settling in the grass beds. The bivalve's life expectancy is about two years.

"For the bay scallops to continue to thrive in North Carolina, fishers may need to be careful not to disturb sea-grass beds when fishing for scallops," says Murphy. "Also, people must avoid polluting the water." ■

A helpful source of information for this article was Wildlife in North Carolina, "Nature's Way," 1982.

Estuarine Trawling:

Study Measures Impacts of Fishing Techniques

By Jeannie Faris Norris



A trawler on the Neuse River

There is no shortage of opinions in North Carolina about the environmental impacts of inshore trawling.

Some say trawling is good for productivity of inshore waters, "cultivating" the bottom sediments and stimulating growth of the tiny creatures that live there. Others say trawling is bad for these waters, unsettling the communities and disrupting their biomass (weight and volume) and ability to reproduce.

The actual effects of this traditional fishing technique have not been studied in North Carolina until now.

As the N.C. Marine Fisheries Commission (MFC) begins to examine the effects of inshore shrimp and crab trawling, a research team is launching a two-year study to measure the impact of trawling on sand and mud estuarine bottoms. The work is funded by the MFC through the Fishery Resource Grant Program, administered by North Carolina Sea Grant. When complete, the research will help the MFC better manage inshore trawling.

"Right now, the argument for or against trawling can be made either way," says Sea Grant researcher Martin Posey, a benthic ecologist at the University of North Carolina at Wilmington. "That's why the study is so timely. The bottom line is that we just don't know. There are so many areas where assumptions have to be made that we cannot make any conclusions about positive, negative or neutral effects."

At issue is the biological productivity and composition of bottom organisms — or benthos — in the estuaries. These areas are prime habitat for soft-bottom organisms that are important food for larger fish, shrimp and crabs.

Part of the study, which begins in February, evaluates the short-term impacts of moderate crab trawling on a previously untrawled area in the Pamlico River region. The research boat, owned and piloted by Henry Daniels of Belhaven, will pull an open trawl and sample the benthos in three areas that are not usually trawled. It will

also sample comparable untrawled zones near each area.

Daniels' research team includes Posey and researcher Larry Cahoon, a biological oceanographer at UNC-Wilmington, who will analyze the results. The team will pull the open trawl long enough to have a moderately heavy impact on the bottom. They will work at three locations in both February and July of 1999 and 2000, sampling before and after their trawls. Their research targets three types of organisms: benthic microalgae, which are important plant producers, especially for small bottom-dwelling animals; meiofauna, which are prey for shrimp and small bottom-feeding fishes; and macrobenthos, such as worms, amphipods and clams, which are food for larger fishes, shrimp and crabs.

The second part of the study examines the cumulative effects of trawling, again pulling an open trawl. The researchers will sample the benthos in two heavily trawled areas of the Pamlico River and two that are untrawled but not closed. The dates — in February, May, July and November of 1999 and in February, May and June of 2000 — will bracket the shrimp and crab trawling seasons and offer good comparisons for seasonal effects.

"The two methods have different strengths and can complement each another," Posey says.

The study focuses on crab trawling because it has more impact on the benthos than shrimp trawling, Daniels says. The research team will avoid state-protected grass beds and primary nursery areas, which serve as crucial habitat for juveniles of many marine species. It will instead focus on nearby sand and mud bottoms, which lack grasses. The mud bottoms are much quieter than sand bottoms and usually are found in deeper channels. Sand bottoms are more comparable to grass beds and contain many of the same organisms.

To date, research on the effects of trawling has been inconclusive, the researchers say. Some studies indicate that

trawling can impact the biomass and productivity of benthic organisms that support fishery species. It may also change the composition of benthic species, which can be critical in the role of benthos as food for shrimp, crabs and fish.

One point of view is that trawling is beneficial, cultivating the bottom and stimulating growth of food organisms. If so, the researchers expect to see relatively high abundances of the sampled food organisms or at least rapid recovery after trawling.

On the other hand, if trawl impacts are significantly negative, then appropriate management strategies — managing catch, trawling areas or seasons — would be worth investigating for specific fisheries, the researchers say. The study results will at least provide some direction on this issue.

Another possibility is that trawling has no significant impact either way.

Although the impacts of trawling have been long discussed, few studies have addressed the well-being of benthic organisms.

For example, a trawl impact study in South Carolina waters focused on bycatch issues, not on the effects of trawling on the food chain organisms that support fisheries. Some critics have charged that trawling not only damages the benthos, it also catches untargeted species. A study of the Carteret County shrimp fishery also addressed bycatch issues.

Studies in other regions are beginning to look at such effects. Researchers found impacts of scallop dredging on soft-bottom communities in Maine coastal waters, and another team found that sheltered, untrawled muddy bottoms in a Scottish sea loch were susceptible to damage by bottom dragging. However, it is not clear how relevant these studies would be to North Carolina's waters.

The MFC has asked the Division of Marine Fisheries to prepare reports on the known impacts of trawling inshore waters, says Nancy Fish, division spokesperson. From these, the commission will identify the research needed to fill in the gaps in data. ■

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From the Editor

Recognizing Excellence

North Carolina Sea Grant has had a bountiful year. Our overall program received an excellent rating from a national review panel. And our staff and *Coastwatch* contributors have taken honors for academic excellence and skillful prose — even boatbuilding.

But there was one day in May that brought a special excitement to our Raleigh headquarters. Our director, Ron Hodson, made his first trip to the office since sustaining critical injuries in a January plane crash in Florida.

Staff members eagerly welcomed Ron as he made his way to his desk. We had been in regular contact with him — quick questions by phone or e-mail, longer meetings at his home. But this was his first return to Sea Grant, where he has served for two decades.

We were happy to have him back — and he looks forward to returning on a full-time basis. In the meantime, he offers many thanks to the friends, colleagues and extended Sea Grant family who continue to offer support through his recovery.

Ron is obviously proud of the “excellent” rating we received from the performance assessment team assigned by the National Sea Grant College Program. The panel spent a week in North Carolina, visiting extension projects along the coast and meeting with university researchers and Sea Grant staff. Read more about the review in *Coastal Tidings*.

Sea Grant communicator Renée Wolcott Shannon took individual honors as the top master’s student in NC State University’s College of Humanities and Social Studies. Renée, who earned a master’s degree in English in May, received the award from Phi Kappa Phi, a national honor society.

Writer T. Edward Nickens of Raleigh won awards from the Outdoor Writers Association of America for a pair of articles from his *Coastwatch* series.

“The Hook,” a story on Cape Lookout that appeared in our High Season 1998 issue, took second place in the natural history category.

“The Point” — a contemporary account of the rich heritage of

Herman Lankford



Cape Hatteras surf fishing that appeared in our Autumn 1998 issue — took second place in the saltwater fishing category.

Julie Ann Powers of Beaufort took Best in Show honors at the Wooden Boat Show sponsored by the North Carolina Maritime Museum. Julie’s account of the joy and frustration of building her first boat appeared in our Winter 1999 issue. Julie recently joined the Sea Grant staff in a part-time capacity to handle communications for the state Fishery Resource Grant program, which is administered by Sea Grant.

In closing, I thank readers who responded to my request for images of the sea and shoreline that inspire a child-like sense of wonder. Two responses remind me that we should not take our coast for granted.

Deb Greene of Galesburg, Ill., has only seen the ocean once — and she admits she felt a “sensory overload” — but the images are still sharp:

“...how the waves kept coming, kept coming, and how the sound of the surf never ended. The brightness of the kites against the gray sky. The weathered faces of the old men fishing in the surf. Picking up a seashell and wondering what are you — where did you come from and how far have you traveled and what is your story?”

Deb returns this year with her family. She’s eager to watch the faces of her sons and 10-month-old grandson as they take their first steps in the surf.

Virginia D. Wiseman of Danville, Va., thanks me for reminding readers about the works of Rachel Carson. “Her writings about Bird Shoal and the Florida Keys were great. We found all the sea life just as she described it,” writes Virginia, who started a scientific collection of seashells in the 1950s.

In the decades since, growth and progress have changed much of the coast and the habitats for sea creatures. “The only place I now find some sea life is at the east end of Ocean Isle,” she adds.

Thanks, Deb and Virginia. Keep the e-mails and letters coming. □

Katie Mosher, Managing Editor

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Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports several research projects, a 12-member extension program and a communications staff. Ron Hodson is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina. *Coastwatch* (ISSN 1068-784X) is published bimonthly, six times a year, for \$15 by the North Carolina Sea Grant College Program, North Carolina State University, Box 8605, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095. E-mail: kmosher@unity.ncsu.edu. World Wide Web address: http://www2.ncsu.edu/sea_grant/seagrant.html. Periodical Postage paid at Raleigh, N.C.

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Front cover photo of an abandoned tugboat and table of contents photo of a stroll along the beach by Scott D. Taylor.

Printed on recycled paper. ♻️

COASTAL TIDINGS

North Carolina Sea Grant Program Rates "Excellent"

North Carolina Sea Grant is at the top of its class.

The North Carolina research and outreach programs are leaders in the National Sea Grant network, according to

a national review panel. The panel gave North Carolina Sea Grant an overall rating of "excellent" during a recent review.

"NCSG has led the nation in several areas, such as creation of a hybrid striped bass aquaculture industry, development of surimi into an industry worth hundreds of millions of dollars annually and identification of *Pfiesteria piscicida* and its potential harm to humans," the report states.

"The North Carolina Sea Grant Program has provided one of the best mechanisms for building cooperation among various groups and has been especially effective in extension and communications programs with end users," the report continues.

The program assessment review team included a university president, a state Sea Grant director, representatives of the National Sea Grant Office and the National Oceanic and Atmospheric Administration, and experts in fisheries and coastal engineering.



North Carolina Sea Grant was cited for producing significant results in areas including coastal studies, ocean policy and coastal public trust, water quality,

fisheries, aquaculture, seafood technology, and training future leaders through a variety of education programs.

"We have always thought that we have done well in those areas. This report proves that we do," says North Carolina Sea Grant Director Ron Hodson.

During the December 1998 review, Sea Grant staff members took the panel on a tour of research and outreach projects along the coast. The team then came to Raleigh for a series of presentations by Sea Grant researchers and staff.

The North Carolina program was cited for its proactive approach to serving the public. In addition to a wide variety of communications products, the program supports public contact with extension staff as well as direct contact with primary researchers.

"This has been extremely powerful in transmitting technology to industry," the team reports.

—K.M.

In the Next Issue of *Coastwatch*

With their powerful waves, the Outer Banks have become one of the most popular places to surf on the East Coast. Ann Green examines the coast's surfing culture and history. She also looks at surfers' impact on the coastal conservation movement. Renée Wolcott Shannon's experience with coastal bird-watching will whet naturalists' appetites for the third annual Wings over Water festival.

COASTAL TIDINGS

Scientists Ponder Farm-raised Flounder

Flounder aquaculture efforts could build upon the success of farm-raised hybrid striped bass, according to a group of North Carolina scientists.

Many lessons learned through North Carolina Sea Grant aquaculture research — from nutrition and disease prevention to pond technology — can be transferred to flounder studies, says North Carolina Sea Grant Director Ron Hodson. He directed much of the hybrid striped bass research that spawned a multi-million dollar industry in the state.

The flounder efforts are gaining steam in the state's research community. A panel of scientists, state regulators and current fish farmers recently released the report "Flounder Aquaculture and Stock Enhancement in North Carolina: Issues, Opportunities and Recommendations." The recommendations include a state-funded hatchery and establishment of a Marine Finfish Aquaculture Committee.

The report is the result of a series of flounder workshops that drew toxicologists, engineers, zoologists and water-quality experts. The meetings were funded by a grant from the North Carolina Board of Science and Technology.

The workshops also had the support of North Carolina Sea Grant, the University of North Carolina at Chapel Hill's Program in Molecular Biology and Biotechnology, the N.C. Department of Agriculture and Consumer Services, the National Oceanic and Atmospheric Administration's Coastal Services Center and the NC State University College of Agriculture and Life Sciences.

The nation now has one commercial hatchery for summer flounder and a handful of grow-out operations, which take the young fish, known as fingerlings, to market size. There are no commercial

hatcheries for southern flounder, which is the focus of Sea Grant-funded research by Harry V. Daniels and Craig V. Sullivan of NC State University.

Southern flounder, which can tolerate lower salinity and higher temperatures, are well-suited for North Carolina operations, Daniels says.

"We have been successful in developing fingerlings," he adds. "We now are moving our focus more into grow-out." This year Daniels anticipates multiple

spawning cycles for the flounder being bred at the Tidewater Research Station in Plymouth.

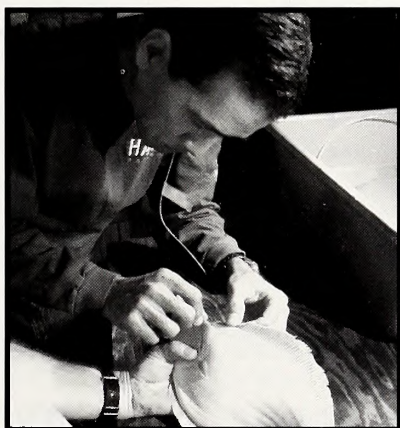
The workshops' recommendations stress the need for a new hatchery. "The state cannot make significant progress in developing flounder aquaculture or answering questions regarding stock enhancement without

the capacity to produce a large supply of healthy flounder fingerlings," the report states.

Other recommendations from the workshop participants include a comprehensive stock assessment of flounder and other marine finfish being considered for aquaculture, as well as incentives and joint research facilities or consortiums to support aquaculture research and development.

The scientists also suggest an integrated permitting process for commercial marine finfish aquaculture and a focus on land-based systems — tanks and ponds — to minimize environmental impact. Finally, the panel recommends a cost-benefit analysis of efforts to enhance wild flounder stocks.

To receive a free copy of the report, call North Carolina Sea Grant at 919/515-2454 or e-mail harriss@unity.ncsu.edu. Fax requests can be sent to 919/515-7095. Ask for publication UNC-SG- 99-02. — K.M.



Joanne Harcke



Join Big Sweep

Want to help clean up North Carolina's waterways? Join the 1999 First Citizens Bank Big Sweep Sept. 18 from 9 a.m. to 1 p.m.

Volunteers from across the state will clean the shores of rivers, lakes and the ocean.

Founded as a coastal cleanup called Beach Sweep by North Carolina Sea Grant marine education specialist Lundie Spence in 1987, the program was expanded inland and renamed Big Sweep in 1989. When all 100 North Carolina counties committed to Big Sweep in 1995, it became the nation's largest statewide waterways cleanup.

Last year, volunteers retrieved more than 268 tons of trash along North Carolina's waterways.

With littering on the rise, more volunteers are needed, including litter collectors, boaters and fishers. To volunteer in your county, call the Big Sweep hotline at 800/27-SWEEP. — A.G.

Bald Head Beauty

Imagine white-tailed deer wandering through a maritime forest as fan-shaped cabbage palmetto trees sway in an ocean breeze.

These animals and trees are found at the Bald Head Woods Coastal Reserve on Bald Head Island, one of eight sites in the North Carolina Coastal Reserve. Officials from the N.C. Department of Environment and Natural Resources and the Division of Coastal Management (DCM), Bald Head Island Ltd. and the Village of Bald Head recently dedicated the 173-acre reserve.

"When people visit the Bald Head Woods Reserve, they get to see a maritime forest that is different from others in North Carolina," says John Taggart, coastal reserve coordinator for DCM. Bald Head Reserve is the only place in the state where you can find cabbage palmetto trees.

DCM acquired the Bald Head site in 1992 with grants from the U.S. Fish & Wildlife Service and the Natural Heritage Trust Fund. Bald Head Island Ltd. donated a portion of the forest valued at \$1 million.

The coastal reserve program is part of the state's Coastal Area Management Act (CAMA). Read about the 25th anniversary of CAMA on page 20. —A.G.

DNA Probe Advances *Pfiesteria* Research

As the weather heats up this summer, North Carolina could see more fish kills and algal blooms. But North Carolina Sea Grant scientists are unlocking the secrets of nitrogen pollution and toxic dinoflagellates, and their findings could help prevent these annual nuisances.

In a project that started with seed money from North Carolina Sea Grant, researchers Parke Rublee and JoAnn Burkholder have created DNA probes that can detect *Pfiesteria piscicida* in water samples. Isolated strands of DNA peculiar to *Pfiesteria* find their genetic mates in the samples, and then DNA amplification or fluorescent dye markers make the presence of the fish killer obvious. So far, the probes have been used to determine the geographic distribution of *Pfiesteria* and to identify two other dinoflagellates,

one of which is a second species of *Pfiesteria*.

The newly discovered species shares many of *Pfiesteria piscicida*'s hallmarks, including a strong attraction to fish, the ability to manufacture toxins, a complex life cycle with an amoebic stage and an animal-like pattern of behavior.

Burkholder's recent research also finds that *Pfiesteria piscicida* prefers a particular larval stage of clams and oysters. Within seconds, the toxic dinoflagellate forces its way between the valves of the larval shellfish and eats the entire organism, except for the adductor muscle. Further research might explain why *Pfiesteria* prefers this larval stage and examine its sublethal and chronic effects on finfish and shellfish populations.

—R.W.S.

Catch-and-Release Fishery Emphasized

As concern grows over dwindling fish stocks, more recreational fishers are turning loose their fish after snapping a photo or tagging their catch. "We really want to emphasize catch and release," says Jim Bahen, recreational fishing agent for North Carolina Sea Grant. "It's easy to catch more than you need."

This year, Bahen is co-chair of the steering committee for the first National Symposium on Catch and Release in Marine Recreational Fisheries Dec. 5-9 in Virginia Beach, Va. The symposium will address hook-release mortality, educational and fisheries management issues, fishing tournament concerns, angler behavior and recreational fishing ethics.

North Carolina fishers may be particularly interested in new research findings on the use of circle hooks

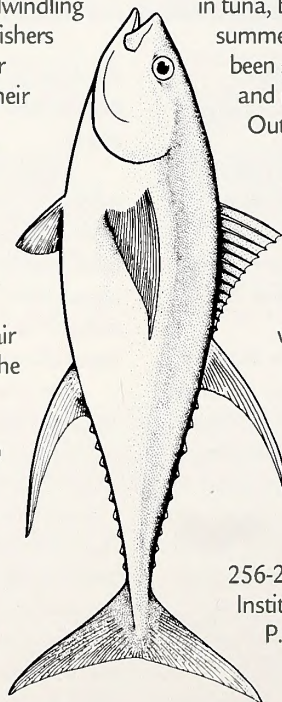
in tuna, billfish, sharks, striped bass and summer flounder. Circle hooks have been successfully used in the catch and release of giant tuna along the Outer Banks in recent years.

Charter captains, fishing tournament organizers and angling leaders are encouraged to attend.

Because the symposium will address fish-discard mortality with the use of rod and reel gear, representatives of the commercial hook-and-line fisheries may also be interested.

For more information, contact Jim Bahen at North Carolina Sea Grant, 910/256-2083, or Jon Lucy, Virginia Institute of Marine Science (VIMS), P.O. Box 1346, Gloucester Pt., VA 23062 (804/684-7166; e-mail: lucy@vims.edu) or visit the VIMS Web site at www.vims.edu.

—R.W.S.



COASTAL TIDINGS

Birders Flock to Wings Over Water

Prowl Pea Island for a rare glimpse of a Western Tanager. Canoe the blackwater swamps of the Alligator River National Wildlife Refuge.

Scott D. Taylor



Perhaps climbing Jockey's Ridge or howling at red wolves is more to your liking. If you're a naturalist, you're sure to find something to suit you at the third annual Wings Over Water festival. This "Celebration of Wildlife & Wildlands in Eastern N.C." is coming up Nov. 5-7. Register now for a wealth of nature-based opportunities.

In addition to bird-watching, hiking and paddling events, Wings Over Water will host workshops on bird banding and plant

identification, seminars on local wildlife, and an outdoor festival featuring vendors, artists and activities for kids.

"This is a family thing," says Jack Thigpen, North Carolina Sea Grant's coastal

recreation and tourism specialist. There are lots of activities for beginning birders and naturalists, as well as for long-time bird-watchers.

For more information or a registration form, contact the Wings Over Water staff at P.O. Box 1808, Manteo, NC 27954, or e-mail wow@outer-banks.com. Check the Web at www.northeast-nc.com/wings.

— R.W.S.

Crab Compost Fills Garden, Not Landfill

Sweet and delicate, blue crab meat is delectable to diners and profitable for North Carolina seafood processors.

But edible morsels account for only 20 percent of a live crab's weight. Patty Buck of Mattamuskeet Seafood Inc., like other processors, faced high landfill bills for disposal of leftover shells.

Buck thought composting the shells into mulch was better, economically and environmentally. A state Fishery Resource Grant helped prove her right.

With \$7,000 granted in 1994, Buck fine-tuned a demonstration project she had developed with Hyde County soil and water conservation agents. Her system mixes shells, other crab waste, cooking water and lumberyard wood scraps.

Composting has saved the Swan Quarter processor at least \$10,000 annually in landfill fees, plus has environmental benefits.

"It is a much more environmentally friendly way to dispose of my waste," Buck says.

Composting has become standard at Mattamuskeet Seafood. "We still use it every day when we are operating," Buck says. "We have never had a problem with it."

The 400 gallons of cooking water used

daily had been another disposal headache. The water, about 40 percent organic matter, now is dripped onto compost to foster micro-organisms and speed the composting process. Previously, Buck's conventional septic field needed frequent replacement.

Buck nurtures her rose garden and corn and soybean crops with the mulch, and shares it with friends. Trial use by Weyerhaeuser Co. tree farms also proved satisfactory. Researchers have found no problems from runoff and consider the composting concept promising for other processors.

Buck credits the Fishery Resource Grant for allowing her to refine her methods. Technical support came from North Carolina Sea Grant; Robert Rubin, an NC State University biological and agricultural engineering professor; Michael Smith of Smith Septic Systems; and Ted Lyon of the N.C. Division of Waste Management.

A similar project is expected soon in Pasquotank County.

For more information on the Fishery Resource Grant Program, administered by North Carolina Sea Grant, call Bob Hines, Sea Grant fisheries agent, at 252/247-4007.

— J.A.P.

Students Debate Coastal Issues

As North Carolina students look toward the 21st century, they face many decisions about the coastal environment — from the quality of the state's water system to the future of beach structures threatened by inlet migration.

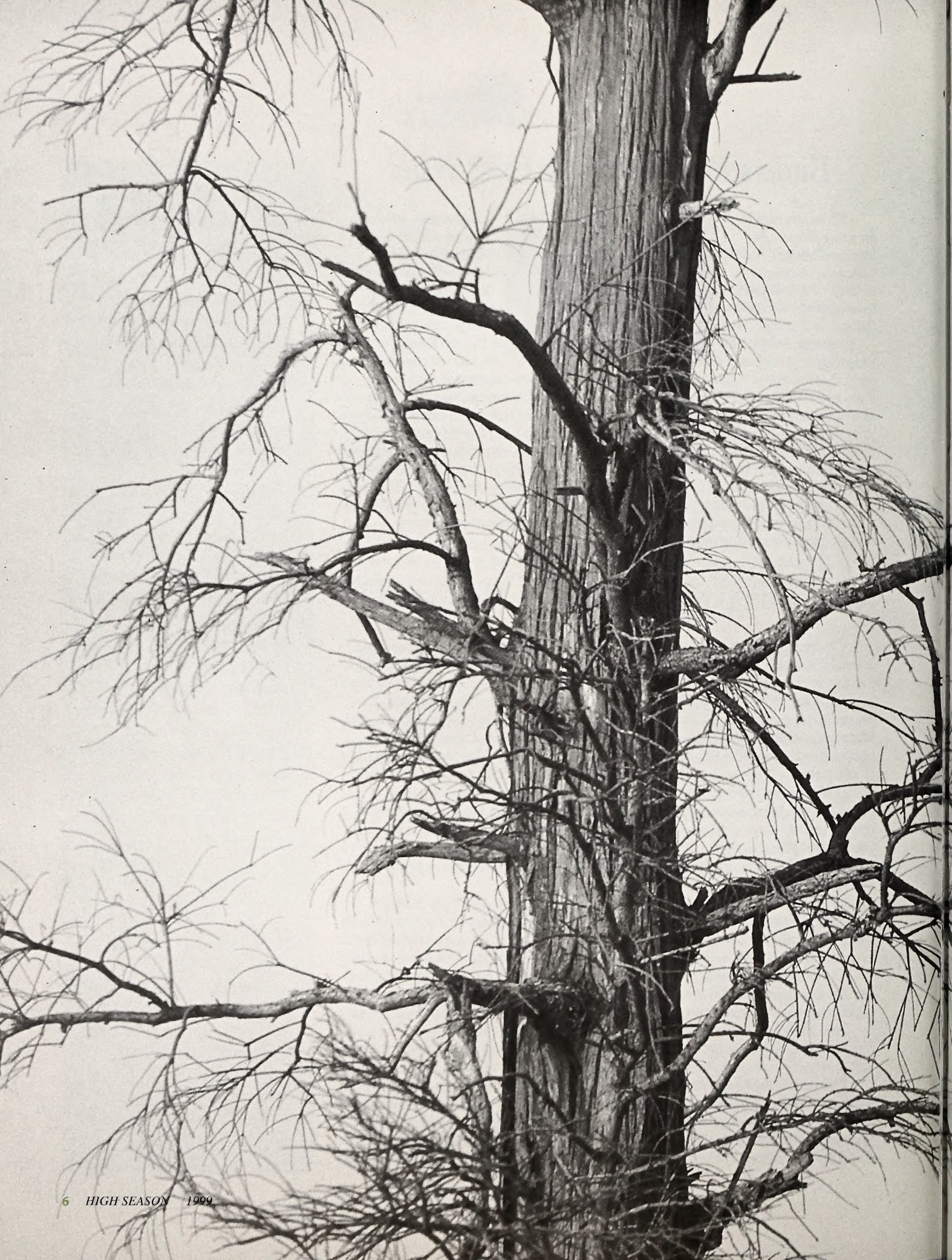
Using desktop videoconferencing, middle school students and teachers from Cabarrus County, Rocky Mount, Raleigh and Hillsborough joined Shaw University education students in debating these issues during spring semester.

Led by North Carolina Sea Grant marine education specialist Lundie Spence, the electronic town meeting on "Environmentally Endangered Sites" was part of Teachers Connect, a micro-Web site of the North Carolina Department of Public Instruction.

"This was a very worthwhile program," says Spence. "All of us had fun expressing opinions and thoughts about North Carolina's public trust rights regarding the beach and the moving of the Cape Hatteras lighthouse."

To find out more about Teachers Connect, e-mail tconnect@hotmail.com or visit the Web site: www.ofps.dpi.state.nc.us/OFPS/tc/forums.htm.

— A.G.



CAPE FEAR

River of Water, River of Time

by T. Edward Nickens



ON ANY OTHER DAY this half-buried log would go unnoticed.

For several hours Jim Bahen and I have been threading a small johnboat down a vernal chasm, the forest-lined lower Cape Fear River, searching for signs of the river's rich heritage as a centuries-old waterway for exploration, commerce and warfare. Bahen, a North Carolina Sea Grant fisheries agent, knows the Cape Fear coastal region with a waterman's zeal, but has rarely ventured above Wilmington; I am simply bewitched with the history of the river's final run to the sea.

At each sinuous river bend we scan high bluff and swampy lowland alike, hoping to spy the rotting remains of an old wharf, perhaps, or the vestige of an ancient steamboat landing long since swallowed by bramble and shrub. We beach the skiff on one particular sandbar to investigate a vertical post that looks positively piling-like, but after a few minutes of study we chalk it up to the work of a beaver. Another false lead in a morning of false leads. Bahen is already back in the boat when the half-buried chunk of wood catches my eye, under a tangle of willows near the base of the river bluff.

I bend down for a closer look. The log is only 3 feet long, but shaped just so, with a blunt, spherical end that looks vaguely familiar. I turn it over, the wood spongy in my fingers. There's a surprise, I think: The log is hollow, split lengthwise, with wooden walls 2 inches thick. I wonder what sort of natural process could have

formed such symmetry when I suddenly suck in my breath. The log has been worked by human hands.

A dugout canoe, or part of it. The bow or stem of some ancient vessel.

I rub my hand through the hollowed cavity — what a find! — and imagination takes flight. A dugout canoe discovered beneath Lake Phelps has been radiocarbon-dated to be 4,400 years old. Could this be as old? Or could it date to the earliest days of European exploration, when French, Spanish and English commanders skittered up the Cape Fear, agog at garden-like forests and brilliantly hued parakeets? At the earliest, I figure, it must date from the 18th or 19th centuries, when Native Americans and colonists alike paddled dugout canoes so large they were fitted with masts and oars, and could hold 50 barrels of plantation wares.

It's been a few hours since we launched our skiff for a day of poking and plodding down the lower Cape Fear, from downstream of Elizabethtown to the Wilmington waterfront. Our plan is simple enough: Armed with daylight and a full tank of gas, we'll let whim serve as a rudder, steering us from riverbank to riverbank. We'll nose up tributaries and around islands, musing about the untold numbers of river travelers — in fishing skiffs, steamboats and wooden barges — who have plied these waters in the past.

Few waters speak of such history as the lower Cape Fear. She is the taproot of

Continued



Top:

A kayaker paddles the tranquil waters of a Cape Fear tributary. Commercial traffic on the river has almost ceased, and it's a haven for those seeking solitude and a close brush with nature.

Middle:

Robin Hall, lockmaster at the Cape Fear Lock & Dam No. 1, points out American shad ready to move upstream to their breeding grounds.

Bottom:

Solemn cypress trees line the riverbanks, looking just as they must have hundreds of years ago, when sailors first braved the Cape Fear waters.

Photos by Scott D. Taylor

the coastal plain, reaching deep into the Carolina Piedmont — past the mouths of the Northeast Cape Fear and Black Rivers, and on towards Elizabethtown, Fayetteville, Lillington. On maps, the Cape Fear begins where the waters of the Haw and Deep Rivers commingle, southeast of tiny Moncure. But in spirit, the river pushes far deeper into the state, draining land as distant as Rockingham County, up on the Virginia line.

We launch our exploration of the little-traveled lower river at King's Bluff, where Lock & Dam No. 1 marks a spot 39 river-miles above the Wilmington waterfront. Opened in 1915, this is the first of three low dams built between Fayetteville and Wilmington, with corresponding locks to raise and lower vessels between the upper and lower pools. Until the railroads outran the steamers, pine-burning paddlewheelers brought the Cape Fear to life. Scores of landings lined each bank, from Wilmington to Cross Creek, ancestor of Fayetteville.

Now commercial traffic has all but ceased. Lockmaster Robin Hall says that he hasn't locked a barge through Lock & Dam No. 1 in four years, although a new project to move cypress logs from Charleston, S.C., to Elizabethtown is expected this summer.

The big excitement at King's Bluff this morning isn't commercial traffic, but fish. As chance would have it, we've arrived during the peak of the American shad migrations up the Cape Fear River, and untold thousands of fish are surging from the ocean upstream to breed. Stymied by the dam, the fish stack up in the tailrace, attracting equally large numbers of fishers.

To help the fish over the dam, Hall oversees a program to "lock through" as many anadromous fish as possible. Three times a day, from the end of February through June, the 200-foot-long lock is "turned around," lifting fish from the lower pool to the upper.

The program has the approval of the U.S. Army Corps of Engineers, which manages the Cape Fear locks, and has been extended to all three dam sites.

With funding from the state's Fishery Resource Grant program, which is administered by North Carolina Sea Grant, Hall has recently finished a three-year study to fine-tune locking methods for the benefit of fish. Mary Moser, a fish biologist from the University of North Carolina at Wilmington, collaborated on the project.

First, shad were tagged with radio transmitters, and their movements tracked as they moved upstream. Once they entered the lock chamber, two radio receiving stations monitored their movements. By changing how the gate doors are arranged to create a gigantic eddy inside the lock, more fish are encouraged to stay in the chamber, and get the lift up and over the dam.

Shad, Bahen figures, as we back our boat into the water, "are the poor man's salmon. And there are still people who live for the arrival of these fish. When the dogwood blooms and the corn gets to be about 2 inches long, they know it's shad time." The instinctive push against flowing water pulls the fish upstream, out of the ocean and into the breeding grounds up the Cape Fear.

OUR DESTINY, HOWEVER, LIES DOWNSTREAM.

From King's Bluff we nose through bottomland hardwoods, scattering double-crested cormorants that launch from the water with ungainly flight. Tatters of gill nets drape streamside trees, like spiderwebs in dew. And everywhere are "bush hooks," as Bahen calls them. I know them by another name: trot lines, long lengths of cord bearing multiple fish hooks, baited with chicken livers and bloodworms, then left overnight.

Each bend in the river brings new discovery: little blue herons like statues of lapis, forgotten shad camps rotting near the river's edge, mossy clay bluffs soaring 30 feet above the skiff. Near one old bluff, somewhere near Pridgen's Landing, I ferret through a tangled undergrowth of greenbrier and cane, in hopes of finding some remnant of a wharf or pier. There is nothing but the sighing of wind in the trees and the pocks of deer tracks in the sand.

It's odd that this river stretch remains

such untrammled country, centuries after European discovery. In 1524, Florentine explorer Giovanni de Verrazzano made landfall at Cape Fear, recording that "The shoare is all covered with small sand ... and beyond this we saw ... many faire fields and plains, full of mightie great woods ... Palme trees, Bay trees and high Cypress trees ... and the land is full of beastes, as Stags, Deere, and Hares."

Two years later Lucas Vasquez de Ayllon appeared under the Spanish flag, but hopes for planting a colony along the Cape Fear were dashed along with his vessel, the first European victim of the river's dreaded Frying Pan Shoals.

The explorer I find most intriguing came nearly a century later. On the morning of Oct. 4, 1662, William Hilton and his ship *Adventure* threaded the Cape Fear shoals and entered the mouth of the river. Hilton sailed under the rubric of the "Adventurers about Cape Fayre," a group of Massachusetts Bay colonists who hoped to move south. Hilton and his crew explored the river mouth region for three weeks before returning northward.

Nearly a year later, Hilton was back. This time he sailed from Barbados, in the same ship, but with a commission from land-starved islanders to explore the Cape Fear's possibilities as a colony site. Hilton cleared the rivermouth on Oct. 16, 1663, and rambled the river and its tributaries for nearly eight weeks. Traveling past the present-day Wilmington waterfront, Hilton explored the Brunswick River and Smith's Creek. He made long forays up the Cape Fear's northeast branch, and described the region in a fine report.

The natives were friendly; in fact, they acted as guides, and helped provision the sailors with a "great store" of fresh mullet, shad, bass and "several other sorts of very good, well-tasted fish." On the banks of the Northeast Cape Fear, Hilton reported finding "as good tracts of land, dry, well wooded, pleasant and delightful as we have seen any where in the world."

In places, Hilton wrote, the woods were "thin of Timber, except here and there a very great Oak, and full of Grasse,

commonly as high as a man's middle, and in many places to his shoulders where we saw many Deer and Turkies; also one Deer with very large horns, and great in body, therefore called it Stag-Park: it being a very pleasant and delightful place, we travelled in it several miles, but saw no end thereof." These savannahs, long since disappeared from the region, would make fine pasture.

The company reported "Partridges great store, Cranes abundance, Conies (rabbits), which we saw in several places; we heard several Wolves howling in the woods, and saw where they had torn a Deer to pieces." Hilton's report is a roll call of long-vanished animals, from gray wolves to the jewel-like Carolina parakeets, or "Parrakeeto's," that thronged the Cape Fear woods in "great flocks." Alligators the length of a horse sulked in rivers and lakes near the sea, their scaly backs "impenitible, refusing a Musquet Bullet to pierce it."

I can't help but wonder what Hilton would think of a metal johnboat, thrumming downstream with the unmistakable growl of an outboard motor. Three centuries have brought much change to the lower Cape Fear. Carolina parakeets have long since disappeared from North Carolina; gray wolves were driven from the coastal plain and the piedmont into the dark recesses of the mountains, where a few hung on into the early 20th century. But in places the green palisades that line the river still hint at the forests that met, and so impressed, the men of the *Adventure*.

AT TIMES, I CAN EASILY IMAGINE

the land that greeted Hilton. Our tiny craft passes along river banks where cypress knees line the shore like nature's bulkheads. Northern parula warblers buzz from the treetops. We cruise in the constant company of turkey vultures and ospreys, riding unseen currents above the trees. At the Thoroughfare, a tree-choked channel that connects the Cape Fear to the Black River, an anhinga perches in a snag, its glossy black wings spread out in the sun.

Continued



The odd bird, almost ghoulish in aspect, is a fitting welcome to the 2,757-acre Roan Island, an isolated, wild tract of swamp with just a fringe of high ground on its northwestern margin. The woods are an alternating tapestry: soaring cypress swamp choked with vine, dark and brooding, then stands of straight-barked gum, like the hair on a mad dog's back. On the high ground yellow wildflowers blaze. We turn upstream into the Black River, where sunlight streams onto marsh grasses a mile away, lighting them like distant groundfire.

Those marshes are a testament to one of the early industries of the lower Cape Fear: rice. Along the Roan Island stretch of river, gaps in the interior forest canopy hint at rice fields of yore; further downstream, marshes cover huge swaths of old rice fields, where the 18th-century planter Robert Schaw had nearly 900 acres of land diked for rice cultivation. But rice culture in the Cape Fear never rivaled that of the South Carolina low country. Instead, it was a natural byproduct of the lower Cape Fear, not a cultivated one, that defined the region for the first few hundred years of European settlement.

From 1720 until the Civil War, the lower Cape Fear region led the world in the production of turpentine, tar and pitch, collectively known as naval stores. North Carolina's interior coastal plain was swathed in part of the nation's finest pine forest.

One early traveler described the pine savannahs between Fayetteville and Wilmington with breathless ardor: "These pines ... grow on an even plain, clear of underwood, so that you may see a cow a mile distant. This, with the symmetry of the trees, and a kind of broom-grass, which was just peeping out, resembling a smooth shorn meadow, gave a beautiful appearance. If you can imagine a number of lofty, straight columns, with a rich green drapery thrown on each, standing on a green velvet carpet, you may form some idea of these barrens. Not a sprig, shrub or brier interrupts the view, as far as the eye can see."



Top: Until early this century, barrels of tar were a common sight on wharves in the lower Cape Fear region, which led the world in the production of naval stores.

Middle: The great pine barrens between Fayetteville and Wilmington yielded tar, pitch and turpentine, mainstays of maritime maintenance and coastal life.

Bottom: The state's largest city for 70 years, Wilmington was a hub of trans-oceanic shipping, sending naval stores and lumber as far away as England.

Photos courtesy of the Cape Fear Museum



Those trees produced a piney resin called turpentine (today's turpentine is actually spirits of turpentine, a distilled product) and the various products of the sap were a colonial mainstay. In their various forms, naval stores were used as a wig adhesive, insect powder, violin bow dressing, and medicine for various internal and external ailments. The resin was used in the manufacture of tallow candles, wood preservative and sheep dip. You could use it to take the hair off a hog or the pinfeathers off poultry.

And naval stores were a mainstay of maritime maintenance. Enormous quantities of tar were used to protect ships' rigging, while pitch made a fine caulking for watertight wooden ship hulls. In a single year, the port of Brunswick, just below Wilmington, shipped 59,006 barrels of naval stores to England.

For two centuries, then, the Cape Fear River clamored with commercial vessels. In the early years of the 18th century, "periaugers" were fashioned from a dugout canoe split lengthwise and widened with boards. As the region's naval stores output increased, a large "flat boat" was designed.

Robert Schaw's sister, Janet, offers a wonderful accounting of her travels in the Cape Fear region in 1775 — *Journal of a Lady of Quality* is its title — and described these barges as large enough to carry 200 barrels of wares, with room in the middle for the slave crew.

An advertisement in the *Fayetteville American* sought to find builders for flats measuring 48 feet by 10 feet and 30 feet by 6 feet, according to F. Roy Johnson's *Riverboating in Lower Carolina*. The boats only got larger. In 1851, according to Johnson, the flat boat *J.L. Cassidy* tied up in Wilmington laden with 554 barrels of naval stores.

Curiously, the flat boats were powered by the tides. Headed upstream or down, the flat boat crew rode the rising or falling tides, tying up alongside the river as the tides changed. Riding the river's lunar surge, and with the occasional help from long poles, flats could negotiate the Cape Fear River as far upstream as White Hall, 54 miles above Wilmington.

We have few reminders of such a time. The day before my river trip I drive out to the Ev-Henwood Nature Preserve, a 174-acre tract of land bordering Town Creek, a Cape Fear tributary about 12 miles south of Wilmington. A short hike among loblolly pines, wax myrtles and sweet bay trees brings me to an odd earthen feature: a mound of dirt heaped up in the woods, with a concave center like the crater of a miniature volcano. The mound is about 5 feet tall, with American holly and turkey oaks growing from the center. I pace 36 steps around the lip — the cone is about 105 feet in circumference.

This curious feature is the remnant of a tar kiln; in fact, it is one of the largest and best-preserved in the state. During the 18th and 19th centuries, the Cape Fear woods were pocked with backcountry kilns, usually consisting of a clay-floored cone of earth 30 feet in diameter. Small strips of lightwood — the dead, resinous heartwood of longleaf pine — were piled into the kiln to a height of 12 or 14 feet. When the stack was fired, heat forced resin from the wood. This resin flowed along the clay kiln floor and into a pipe, which drained the kiln of tar that dripped into a wooden barrel buried underground. The fire would burn for four to five days, producing 160 to 180 barrels of tar, each barrel holding about 32 gallons.

In the century before the Civil War, the Cape Fear lowlands sparkled with kiln fires. Pungent black pine smoke drifted across the river, where slaves sang chanteys as they poled the flats with the rising tides. But North Carolina's naval stores industry suffered after the Civil War. The vast longleaf forests were leveled, and the demand for pitch and tar decreased with the advent of steel-hulled ships and wire and cable rigging. Naval stores would continue to be produced in the region into the 20th century, but it would be a mere remnant of the enterprise that turned the lower Cape Fear into a cornerstone of the British empire.

BELOW ROAN ISLAND, the long, marsh-fringed left bank of the river signals a shift in topography. Gone are the high

bluffs nodding over the stream. The married flow of black water and brown wends through a palm-flat landscape, white clouds scudding over distant trees. The river widens to 200 yards or more. We pass the marshes of Robert Schaw's old rice fields, duck under the bascule bridge at Navassa, and skirt Horseshoe Bend, a large river oxbow used by sailing ships as a natural turning basin.

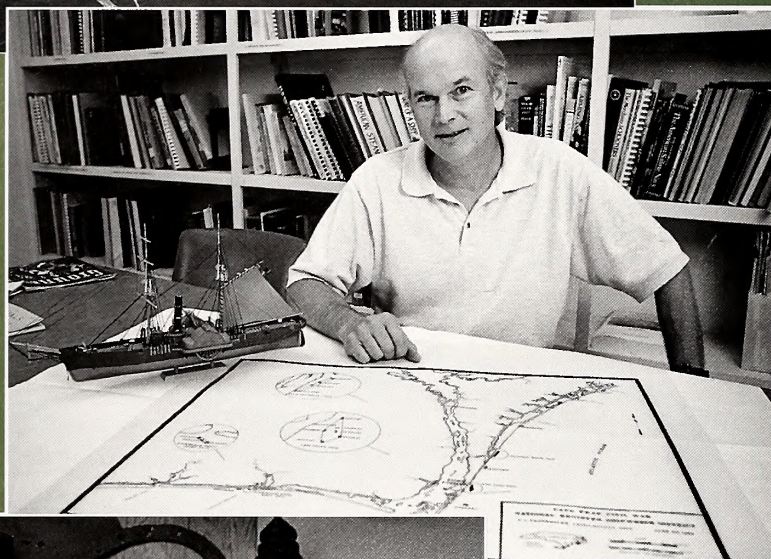
And then, suddenly, the Wilmington waterfront appears. Just past the U.S. 421 bridge, the river's northeast and northwest branches merge at Point Peter, and the famous spires of Wilmington's churches etch the horizon. The vast marshes recede. In their place is the cosmopolitan town clustered on a bluff on the river's eastern bank.

Shipping out lumber and naval stores, Wilmington was the state's largest city from 1840 to 1910, presenting a bank of handsome brick and stone buildings lording over a harbor whose wharves bristled with ship masts. It's an impressive view from the water even today, and one that once was coveted by a certain group of Cape Fear mariners — the blockade runners.

Thirteen days after the evacuation of Fort Sumter, President Abraham Lincoln declared a blockade of the entire Southeastern coast, from Virginia's Fort Henry to the Mexican border. Covering some 4,000 miles of shore, Lincoln's action drew derision, but it also led to a booming industry as ship captains scrambled to deliver war material and everyday items through the Federal blockade. Successful runs meant enormous profits; goods often were sold for 500 to 1,000 percent of their original cost. Buy \$10 worth of quinine in Nassau and you could sell it for \$400 to \$600 in Southern ports.

Bankrolled largely by British interests — English mills ran on American cotton — blockade runners first slipped through the loose Federal noose in anything that would float. But as steam power matured, the Federal blockade tightened with faster, more heavily armed

Continued



Top:

Though the Cape Fear waters are peaceful now, they were the backdrop for violent struggle during the Civil War, when blockade runners delivered war materials and everyday goods to a beleaguered South.

Middle:

Richard Lawrence, head of the state's Underwater Archaeology Unit, is an expert on the maritime history that has strewn Civil War relics up and down the Cape Fear coast.

Bottom:

Archaeologist Nathan Henry displays a rifle, cannonballs and other artifacts recovered from shipwrecks in the Cape Fear region.

Photos by Scott D. Taylor

blockaders. England and the South answered with ships designed to float low and run fast: side-wheeled steamers with low profiles and hinged masts, fueled with smokeless anthracite coal. The nautical game of cat-and-mouse began.

Sailing largely from Bermuda and Nassau, the blockade runners waited for dark nights to shield their craft and for rising tides to carry them over the Cape Fear's shoals. If discovered, blockade runners would cut and run. If cornered, they would drive their craft to the beach, where Confederate and Union forces clashed over salvage efforts.

"There were a lot of epic struggles out there," Richard Lawrence tells me. Lawrence is the head of the state's Underwater Archaeology Unit (UAU), housed in a compound of tan buildings and brown sheds under live oaks on the Cape Fear River near Fort Fisher. I visit him there the day before my river trip, hoping that he can show me the odd relic from a blockade runner or two: a wormy piece of ship planking, perhaps, or better yet a rifle barrel or ship's wheel.

Like most North Carolinians, I've heard of blockade runners, and can sketch in the merest notion of how the blockade operated. But I really have no idea of the strategic role Wilmington played in maintaining the South's armaments and economy during the war. And I am certainly surprised by the treasure that reposes in the UAU's nondescript storage houses.

As many as 50 Federal ships were stationed off the Cape Fear region's two ocean inlets, but still there were 1,700 successful runs against the Union gauntlet before Fort Fisher fell in January 1865. During the entire course of the war, 1,149 blockade runners were captured, and 355 others were sunk or otherwise destroyed. A tenth of those now lie underwater off the Cape Fear shore.

One of those is the *Modern Greece*, a British screw steamer pressed into blockade-running service early in the war. On the morning of June 27, 1862, the ship was sighted by a Federal cruiser just three miles

off Fort Fisher. In the ensuing chase, another Federal blockader joined the melee, and the *Modern Greece* turned to shore and grounded herself. A hasty salvage effort by Confederate forces brought out liquor and clothing, and then the guns of Fort Fisher opened up to scuttle the ship before the enemy could arrive. That was an easy enough task: The blockade runner was carrying 1,000 tons of gunpowder.

One hundred years later, the Ash Wednesday Storm of 1962 raked away the deep layer of sand covering the *Modern Greece*. Discovered by Navy divers on vacation, the newly emerged shipwreck was the subject of intensive salvage efforts throughout the summers of 1962 and 1963. Some 11,500 artifacts have been recovered. Many have been sent to museums and institutions, but thousands more lie in state in the UAU's various storerooms, sheds and desalination tanks.

In one back room, behind the vats, drums and various tubs that hold relics from the recently salvaged ship thought to be Blackbeard's *Queen Anne's Revenge*, an astounding collection of *Modern Greece* cargo lies shuttered away. Rows of gunstocks recline on wooden pegs. Corroded gun barrels are stacked in bins. Piles of cannonballs rest on shelves. There are chisels, axe heads, wrenches, pickaxes, leather scabbards.

Divers recovered 148 complete bayonets, 107 Bowie knives and 732 pocketknives packed in cases. Scores are displayed in the storeroom. "It's probably the biggest Civil War Bowie collection anywhere," says Wayne Lusardi, a UAU archaeologist. He pulls one knife from a pegboard display. The German silver pommel boasts a half-horse, half-alligator figure in low relief. The motif, Lusardi says, is reminiscent of Jim Bowie and his lauded fighting techniques.

Next, Lusardi picks up four Enfield rifles, corroded together, and explains how immersion in saltwater affects such artifacts. "As the iron is breaking down," he says, "rust is literally building up around the artifact, and it forms a concretion —

a mixture of corrosion products like hematites and magnetites, calcium carbonate from sea creatures, and mixtures of shells and sand."

To the untrained eye, the mass of rust, metal and assorted gunk seems a total loss. But conservators use X-rays to see what lies within the balls of rust, and pneumatic air chisels and hand tools to remove the layers of concretion. Next, artifacts go into desalination tanks — basically rubber tubs filled with water and soda ash — and then into electrolysis.

That process takes an enormous amount of time, and no small pot of money. "Unfortunately," explains Nathan Henry, another UAU archaeologist, "it takes a certain amount of resources to conserve these things, and there's not a good place to put them. These rifles don't need to be in our back room; they need to be out where the public can see them. But too often, the stuff you pull from underwater isn't really museum quality. They can be pretty rough."

But they have an allure, a sense of history, that polished carbines and immaculate reproduction uniforms can hardly match.

I can't help but think of those artifacts as Bahen and I putter past the Wilmington waterfront. Only 39 miles of the lower Cape Fear have passed beneath our boat, and we are loathe to bring the day to an end. It is quite a different emotion than the one expressed by old blockade-runners as they caught sight of Cape Fear's port city.

"It will be difficult to erase from my memory the excitement of the evening we made our little craft fast alongside the quay at Wilmington," wrote the captain of the blockade runner *Don* of his first successful run of the blockade. "The congratulations we received, the champagne-cocktail we imbibed, the eagerness with which we gave and received news..."

No cheering crowds greet us at the boat ramp, but there are other profits from our river run. Before the *Don*'s docking and since, the lower Cape Fear's riches have drawn the adventurous and curious alike. I suspect it will always be so. ■

LEARN MORE ABOUT Cape Fear History

When summer ends and snorkelers, sunbathers and various other seasonal seafarers depart, a quieter, more contemplative beauty envelops the Cape Fear region. For many, it's the perfect time to pay a visit — especially for history buffs, because the N.C. Maritime History Council will host its annual conference Oct. 28-30 at the Cape Fear Museum in Wilmington.

The Cape Fear region will be the focus of the conference. Topics include Wilmington architecture, underwater archaeology of the Cape Fear River, the settlement of Charles Town and the Barbados/Cape Fear connection, archaeological and historical aspects of Brunswick Town, and the Cape Fear region during Civil War times.

The conference opens with a reception Thursday evening. Friday includes an optional field trip, presentations and dinner. The conference ends Saturday at noon. There will be a registration fee. Council membership is not required.

For more information, contact Richard Lawrence of the N.C. Department of Cultural Resources, Underwater Archaeology Unit, P.O. Box 58, Hwy. 421 South, Kure Beach, NC 28449, 910/458-9042. E-mail: rlawrence@ncsl.dcr.state.nc.us.

A 1992 *Coastwatch* special edition, *North Carolina's First Inhabitants*, details archaeologists' efforts to unearth clues to Native American history. One article describes the Cape Fear-area Waccamaw tribe's efforts to reclaim and recover its lost heritage.

To order a reprint, ask for publication UNC-SG-92-13 from North Carolina Sea Grant, Box 8605, NC State University, Raleigh, NC 27695-8605. Please include a check or money order for \$2.50 to North Carolina Sea Grant. For further assistance, call 919/515-2454. ■ — C.H.V.

Pettigrew State Park

HOME TO ANCIENT LAKE, TREES, CANOES

By Ann Green • Photographs by Scott D. Taylor

As Sid Shearin heads deep into the forest at Pettigrew State Park, he points to a majestic bald cypress tree that towers near the Lake Phelps shoreline.

Several years ago, Shearin, the park's superintendent, nicknamed the 120-foot tree the "Lake Phelps monster" because of its bizarre shape and hollow spots that look like peering eyes. The tree's swollen buttress has a cavity large enough for children to hide in.

"This tree probably got started in the water 100 or 200 years ago," says Shearin. "The shoreline has gradually caught up with it. We think this area on the northern rim of the lake is a virgin forest."

The mighty trees are so unusual that Shearin has named several of them — from the "wishing well," a hollow sycamore stump, to "the tunnel," a hollow sycamore tree that can be entered from the picnic area or parking lot. "I'm the tree nut of the state park system," says Shearin. "Trees are my bag. I started naming trees when I started having children."

During a "Paddle to the Sea" workshop several years ago, Shearin

shared his enthusiasm with North Carolina Sea Grant education specialist Lundie Spence and teachers from across the state. "By the end of the workshop, we were all hugging the trees and measuring their diameters," says Spence.

Draped in Spanish moss, the cypress trees along the northern shore of Lake Phelps — the state's second largest natural lake — evoke an eerie, mystical feeling. They also give you a glimpse into an area in northeastern North Carolina that was once dominated by swamplands.

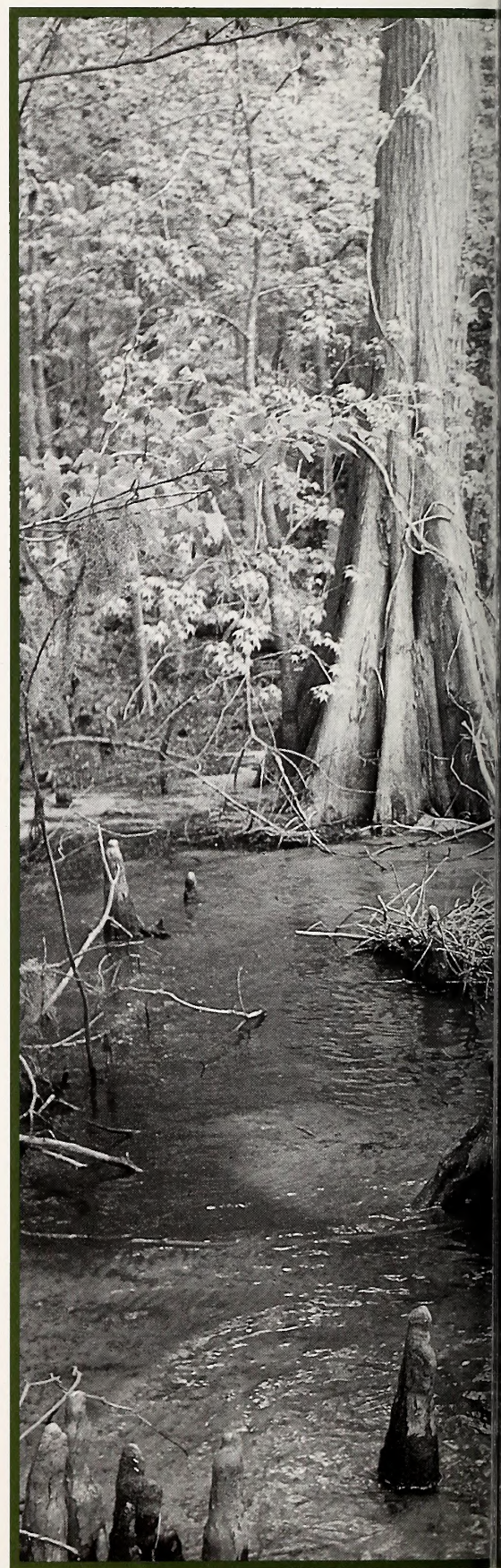
Hike farther down a short trail covered with cypress needles and discover the 350-foot boardwalk on Moccasin Overlook that extends into Lake Phelps.

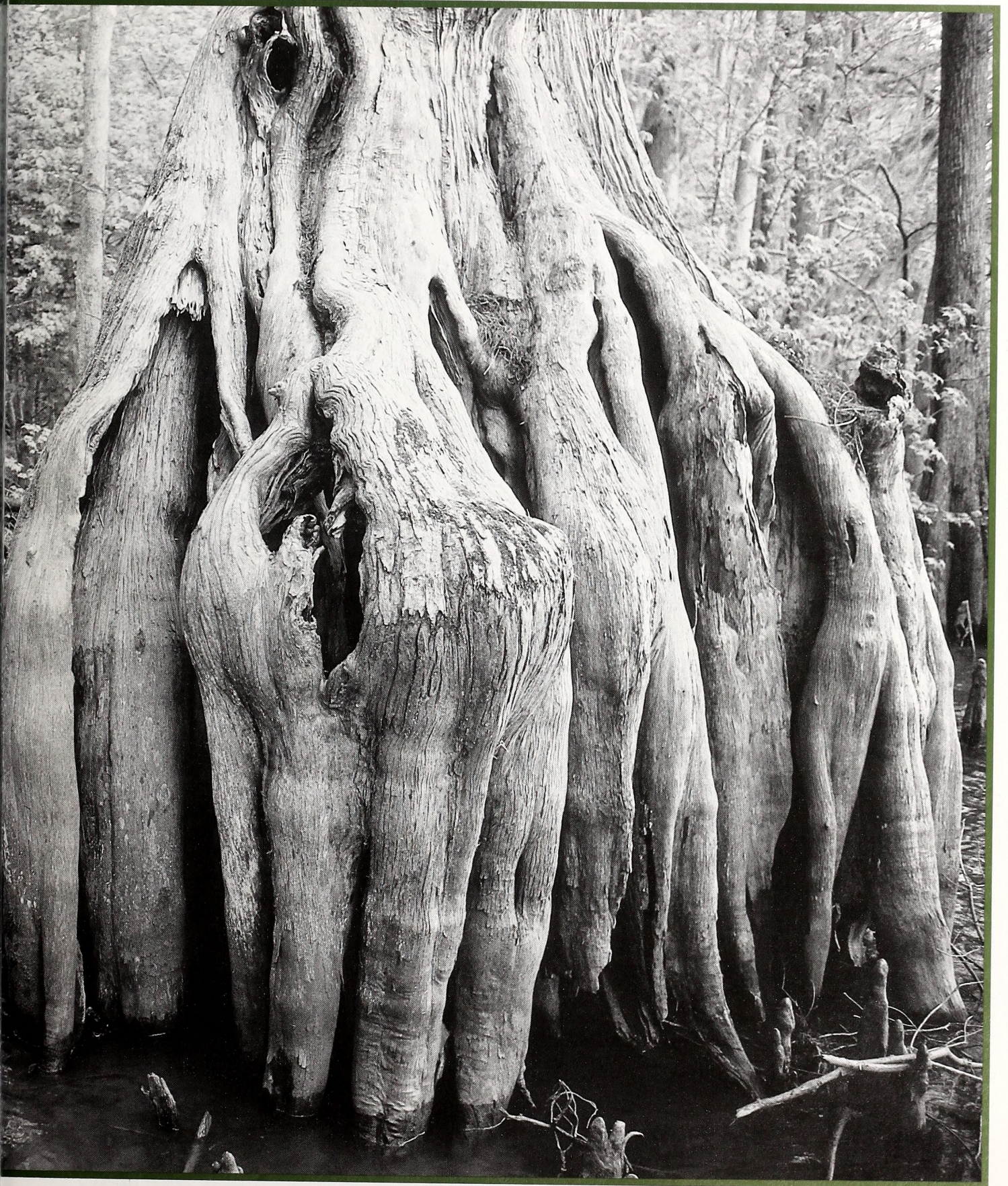
"This is the most scenic point in the park," says Fred Spear, the son of the late Robert Spear, Pettigrew Park's chief ranger for more than 40 years. "In the winter, this is the best place to view waterfowl."

Away from the water's edge, large sweetgum and tulip poplar trees dominate the forest, and vines as large as human thighs wind their way up some trees.

Continued

At right: A towering bald cypress tree is nicknamed the "Lake Phelps monster" because of its bizarre shape and hollow spots.





Many of the mighty trees have been named state and national tree champions. In 1992, there were eight state champions. Five years after that, the swamp bay and coastal plain willow were named national champions based on their height, the spread of their branches and their trunk circumference or girth.

Nature lovers are attracted to the park's wetlands, trees and wildflowers, which lend color and beauty to the forests. In the spring, white *Atamasco* lilies blanket almost one acre.

The 1,144-acre park, tucked away in the fertile farmlands of Washington and Tyrrell counties, is home to Lake Phelps, known as an angler's paradise throughout the east because of its bass fishing.

"It is known for fishing more than the other lakes in the state park system," says Shearin. "The big three are large-mouth bass, yellow perch and pumpkinseed."

For more than 35 years, recreational fisher Dick Davis has been reeling in bass at the crystal clear lake.

"I like it because you can wade in Lake Phelps and get bass," says Davis, who lives in Creswell. "This lake is as good as you can get for bass fishing in northeastern North Carolina."

Fishers also use the 300-foot fishing pier at Cypress Point.

Occupying one of the highest sites in the area, Lake Phelps — which stretches over 16,600 acres of water — has an unusual ecology. It is shallow, with an average depth of 4.5 feet and maximum depth of 9 feet. The water is fresh but acidic due to tannic acid from the surrounding peat lands. When the water is clear, you can see down to the sandy bottom.

"Lake Phelps and White Lake are the only clear lakes in North Carolina," says Shearin. "Since there is no city or agricultural runoff into the lake, it is one of North Carolina's least polluted bodies of water. Only rain feeds into the lake."

The shallow water and wind conditions make the lake ideal for



The shore of Lake Phelps is surrounded by diverse plants and ancient forests.

shallow-draft sailboats, canoeing and windsurfing.

It is rarely crowded and great for kids, says Mike Noles, who runs a rental company and campground on Lake Phelps. "We say it is one of the best-kept secrets in eastern North Carolina."

Bikers can cycle the north and western shores of Lake Phelps. The trail runs over eight miles through the big-tree forest, near scenic overlooks, and to historic Somerset Plantation and other sites.

"Pettigrew is the only state park in the eastern part of the state with bike paths," says Shearin.

Formed on a vast peninsula between the Albemarle and Pamlico sounds, Lake Phelps is thought to be 38,000 years old. Scientists have long puzzled over its origin.

"One theory is that wind and wave action carved out the lake when the ocean covered eastern North Carolina," says Shearin. "Another popular legend

is that peat fires burned a hole big enough for a lake. Some even say Paul Bunyan made a footprint that formed a sinkhole."

Artifacts reveal the presence of Native Americans as early as 8,000 B.C. The most fascinating discovery was a collection of dugout canoes — 30 at last count — found in the lake after an extensive forest fire in 1985. The lake level dropped when water was pumped for the fire.

"A park official discovered the canoes while checking on the tundra swans," says Spear. "The water was so shallow that a swan's web feet brushed the sand off of a canoe."

The Algonquian Indians made the dugout canoes by burning the interior of cypress logs and scraping away the charred wood until only a shell remained. Archaeologists believe the

seasonal campers sank their canoes in the lake's shallow water to store them until the next hunting or fishing season.

Some of the canoes are displayed at the boat ramp on the lake's northeastern side. One that extends 37 feet is thought to be the longest known canoe in the Southeast. Another one, built more than 4,400 years ago, is the second-oldest canoe in the country. Because the canoes are so ancient, some are mere remnants. Others remain mostly intact.

"The restricted water movement and the acidity of the water at Lake Phelps contributed to their preservation," says Shearin. "Most of the canoes are still in the lake."

The canoes aren't the only historical attraction at the park. To get a glimpse into plantation life, you can tour Somerset Place, which occupies eight acres. With its formal gardens, expansive

porches and expensive furnishings, the antebellum mansion reflects the lavish lifestyle of wealthy planter Josiah Collins III. The surrounding outbuildings served the slaves, who cultivated corn and rice.

A mile east of Somerset, Civil War buffs can view the graves of three members of the Pettigrew family — Confederate General James Johnson Pettigrew, the park's namesake; his father, Ebenezer Pettigrew, a prominent planter and congressman; and his grandfather, Charles Pettigrew, the first bishop-elect of the Episcopal Church in North Carolina. James Pettigrew led North Carolina's 26th Regiment in the famous high-water-mark charge at Gettysburg.

"Pettigrew was a brilliant general," says Shearin, who has dressed as General Pettigrew during park programs. "The first day in battle he was seriously wounded and survived."

The Pettigrews lived on a family farm, Bonarva, which was nationally recognized as a model of scientific farming and management in the 1830s. All that remains of the plantation is some rubble near the carriage road and several trees planted by the family.

During the 1930s, the Federal Farm Security Administration purchased the Collins mansion and surrounding lands, which were incorporated into the Scuppernon Farms Resettlement Project. The state



White Atamasco lilies blanket a trail on the northern shore of Lake Phelps.

C o n t i n u e d



Pettigrew Park Superintendent Sid Shearin is known as the "tree nut" of the state park system.

gained control of the park in 1939, and Pettigrew became the sixth state park. In 1998, 82,000 visitors came to the park, according to Shearin.

With its abundance of wildlife, the park has become a haven for bird-watchers. Ducks, geese and swans flock to the park in the winter. "December is the best month to view the waterfowl," says Shearin.

Osprey, owls and hawks also perch on the park's giant trees and feast on rodents from adjacent fields of corn and soybeans. The lakeshore provides a habitat for kingfishers, herons, egrets and other birds that seek food at the water's edge.

It is not unusual to see white-tailed deer, raccoons, muskrats, possums and foxes roaming through the woods, particularly on the south side. Numerous black bears, which weigh up to 600 pounds, live in the park as well.

"We were out fishing one day and saw something black in the water," says Spear. "It was a young bear swimming in the water. Sometimes the mothers on the south side of the lake bring their cubs to the north side to wean them."

Endangered red wolves, reintroduced in northeastern North Carolina in 1987, roam along a 500-acre pocosin tract, an upland swamp. The tract, which borders the Pocosin Lake National Wildlife Refuge and is near an access to the lake, has never been bulldozed. It is filled with bay trees, pines, gallberry shrubs and sundew, a carnivorous plant that eats insects.

With its abundant wildlife, colorful history and popular fishing spots, the park is a great discovery for North Carolina travelers.

"I think it is one of the most beautiful lakes that I have been on," says Davis. "You can find lily pads,

reeds, trees and different birds along the shore. If the lake is clear, the stumps and logs on the bottom make a pretty sight. When the trees turn in November, the forest is absolutely gorgeous. It's like going to the mountains." ■

Pettigrew State Park is seven miles south of Creswell off U.S. 64 and S.R. 1168. Park hours vary by season.

Daylight hours are: June through August, 8 a.m. to 9 p.m.; April, May and September, 8 a.m. to 8 p.m.; March and October, 8 a.m. to 7 p.m.; and November through February, 8 a.m. to 6 p.m.

Primitive youth tent camps are available. To ensure availability, reservations are advised. Thirteen family campsites are available on a first-come, first-served basis. For more information, call the park office at 252/797-4475 or visit the park's Web site: <http://ils.unc.edu/parkproject/pett.html>.

Discover Unique Resources

AT COASTAL STATE PARKS

By Ann Green

Along North Carolina's coastal plain, state parks showcase unique natural resources and treasures — from loggerhead turtles nesting on the beach at Fort Fisher to chiseled cliffs along the west bank of the Neuse River.

Travelers can view many of the unique resources in the state's 15 coastal parks.

"All the coastal plain's state parks in North Carolina are different," says Tom Howard, naturalist for the N.C. Division of Parks and Recreation. "Each one is representative of the natural community around it."

At the parks, residents also can get a close-up of wild lands that would be inaccessible if owned by private citizens, says Jack Thigpen, North Carolina Sea Grant coastal recreation and tourism specialist. In addition, they can learn much from the park's interpretive programs.

A few of the coastal parks are highlighted below. For a listing of all coastal parks and park hours, visit the Web at <http://ils.unc.edu/parkproject/ncparks.html>.

• Carolina Beach State Park

Spot the rare Venus flytrap and other species of insect-eating plants along five miles of trails. Stop and rest at the new 5,000-square foot visitors center. The center's exhibit hall, which focuses on the biodiversity of the park's plant and animal life, will open this fall.



Birds throng the shore of Roanoke Sound at Jockey's Ridge State Park.

The park is 10 miles south of Wilmington off Hwy. 421 in New Hanover County. For more information, call 910/458-8206.

• Fort Fisher State Recreation Area

Spend the day away from crowds on a four-mile stretch of undeveloped beach where shell-seekers can find treasures. Catch a glimpse of a loggerhead sea turtle nesting, or pelicans and other birds swirling and turning in the wind.

The recreation area is five miles south of Carolina Beach, off U.S. 421 in New Hanover County. From Brunswick County take the Southport-Fort Fisher ferry. For more information, call 910/458-5798.

• Fort Macon State Park

Tour the restored fort that stood guard over Beaufort Harbor during the Civil War

or hike the Elliot Coues Natural Trail, which circles through a shrub thicket and back to the parking area.

To reach Fort Macon, take U.S. 70 to Morehead City, cross the bridge to Atlantic Beach and turn left onto Hwy. 58. The park has a bathhouse that is open all year. For more information, call 252/726-3775.

• Hammocks Beach State Park

Venture to Bear Island and view one of the most beautiful and unspoiled beaches on the Atlantic. Discover where loggerhead sea turtles come ashore under cover of darkness to nest above the tide line.

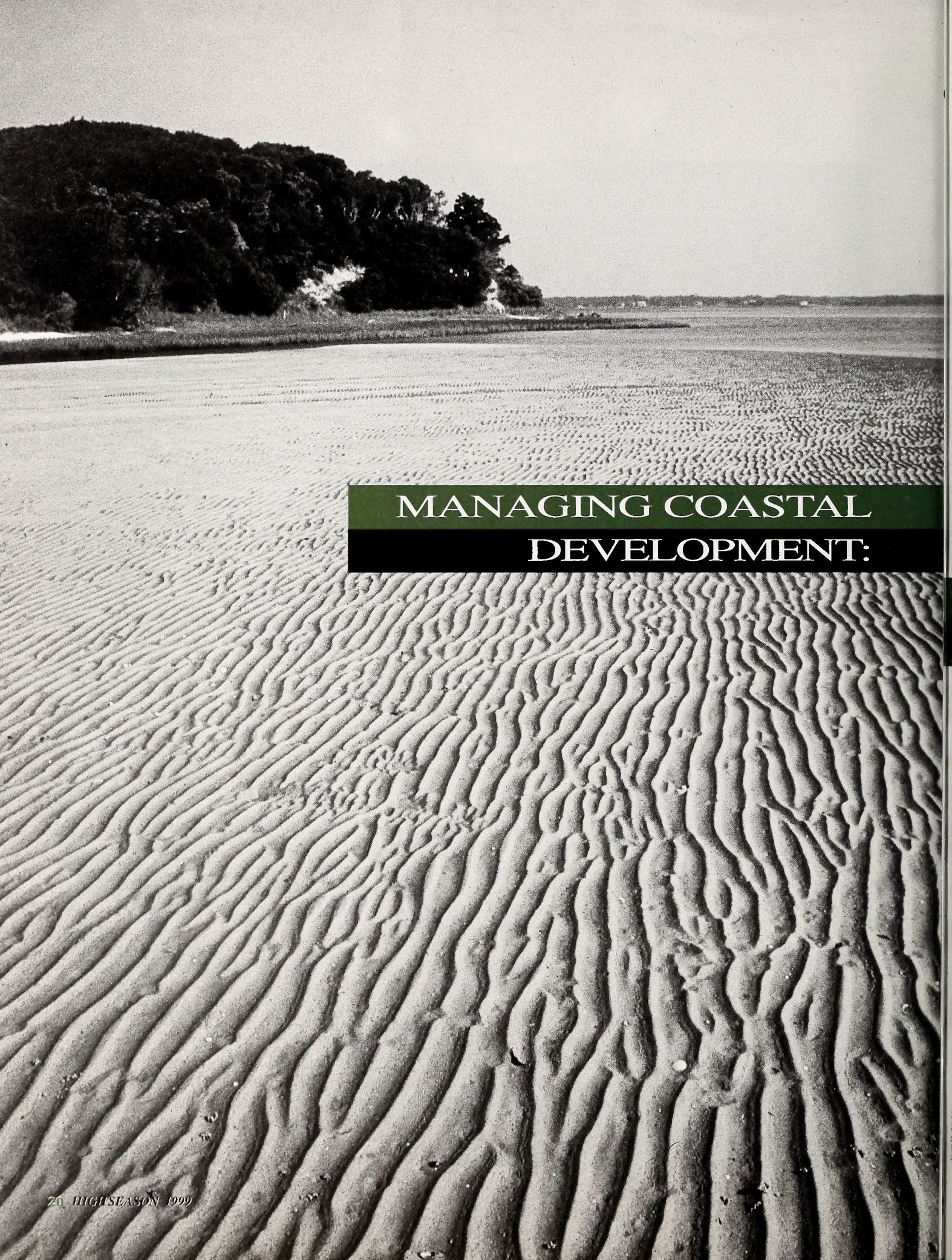
The park's mainland is in Onslow County. From Swansboro, take Hammocks Beach Road to the park entrance adjacent to Queens Creek. A passenger ferry departs for Bear Island. The park is accessible only by boat or passenger ferry. For more information and ferry times, call 910/326-4881.

• Jockey's Ridge State Park

Fly a kite or hang glide on the highest sand dune on the East Coast. Tour fascinating exhibits about sand, winds and weather at the visitors' center.

The park is at Milepost 12 on U.S. 158 bypass in Nags Head. Turn on Carolista Drive. For more information, call 252/441-7132. ■

N.C. State Parks



MANAGING COASTAL
DEVELOPMENT:

The North Carolina coast is a study in contrasts,

from bustling boardwalks to sleepy sounds, from ecological wonders to economic windfalls.

In the past generation, coastal life has changed as more visitors and new residents arrive in the 20 coastal counties. For some, the development seems fast and harsh. Others see economic development hampered by government regulation.

At the center of coastal debate is the state's Coastal Area Management Act, known as CAMA. Since 1974, the law has set the stage for development decisions in crucial areas.

property owners to control the use of their land.

While CAMA requires the state to protect the unique coastal ecosystem by designating areas of environmental concern, the law also calls for economic development in counties that traditionally are among the state's poorest. The combined mission is "sustainable development," Clark says.

Donna Moffitt, director of the N.C. Division of Coastal Management, agrees. "We've got to ensure that the development doesn't ruin the resources that draw people to the coast."

Coastal Zone Management Act said that if the state did not develop plans for coastal areas, the federal government would. "That scared the devil out of everybody," Stick says.

CAMA had an early benefit. "For the first time, it forced local officials to take a hard look at the consequences of actions they take," Stick says.

CAMA has drawbacks, such as an inability of some officials to consider the human side of certain requests. "I've cursed it myself," Stick says of CAMA.

Webb Fuller, Nags Head town manager, says the timing of CAMA was critical, as an even greater surge would come in the 1980s. "The framers were visionaries. They were able to develop a very broad structure that allowed for specific rules and regulations."

Looking at the law's core values of conservation, preservation and economic development, Fuller says CAMA has worked. "Nobody gets everything they wanted. If we didn't have this, we would have a hodge-podge of development that could have destroyed some unique natural areas."

Todd Miller, executive director of the N.C. Coastal Federation, says CAMA started strong but lost steam in the 1980s. "For nearly two decades, the tide has been ebbing on coastal protection efforts in North Carolina. It's too early to say the tide has turned, but the outgoing current has slacked somewhat."

Yet CAMA has frustrated some business leaders. "It has been more successful on the environmental protection side than on the economic development side," says Donald Kirkman, executive director of the Carteret County Economic Development Council.

Proposed rules for shorelines along rivers and estuaries now spark strong

C o n t i n u e d

Balancing Environmental and Economic Needs by Katie Mosher

CAMA requires counties to adopt land-use plans and establishes the 15-member Coastal Resources Commission (CRC) to set state policy. The commission reflects a variety of interests, from local government to developers, fishers to conservation groups. The panel also includes three at-large members and experts in coastal engineering, marine biology, coastal agriculture and forestry. The CRC also has input from the Coastal Resources Advisory Council, which has representatives from each county.

The CRC brings many voices to the discussion of coastal issues, often forging compromises on policies, says Walter Clark, coastal law and policy specialist for North Carolina Sea Grant.

Many debates are split between two distinct philosophies, Clark explains. One calls for the state to protect the health, safety and welfare of the public and the environment. The other calls for

A Coastal Boom

In the 1940s, the North Carolina coast had traditional fishing villages and some vacation spots near Wilmington and Morehead City. Compared to Virginia Beach, Myrtle Beach or Ocean City, Md., the North Carolina beach communities kept a simpler flavor, says Charles Jones of the N.C. Division of Coastal Management. "North Carolina has developed into the family beach atmosphere," he says.

By the dawn of the 1970s, the post-war boom had sprouted new communities on Topsail Island and the Outer Banks. State and local leaders began to see a need for a comprehensive look at coastal development. "There was a tremendous influx of new residents in the coastal area," recalls David Stick, former chairman of the Dare County Commissioners and of the CRC.

At the same time, the federal

debates. The rules arose as developers' focus shifted to the tributaries that feed the state's sounds.

"Local governments are saying enough is enough," Kirkman says. "We are concerned about the ecosystem. We want to protect it, but we can't look at it in isolation."

The CRC has expanded the shoreline discussion. "Fresh-water wetlands are very important for filtering and absorption of storm water," Moffitt says.

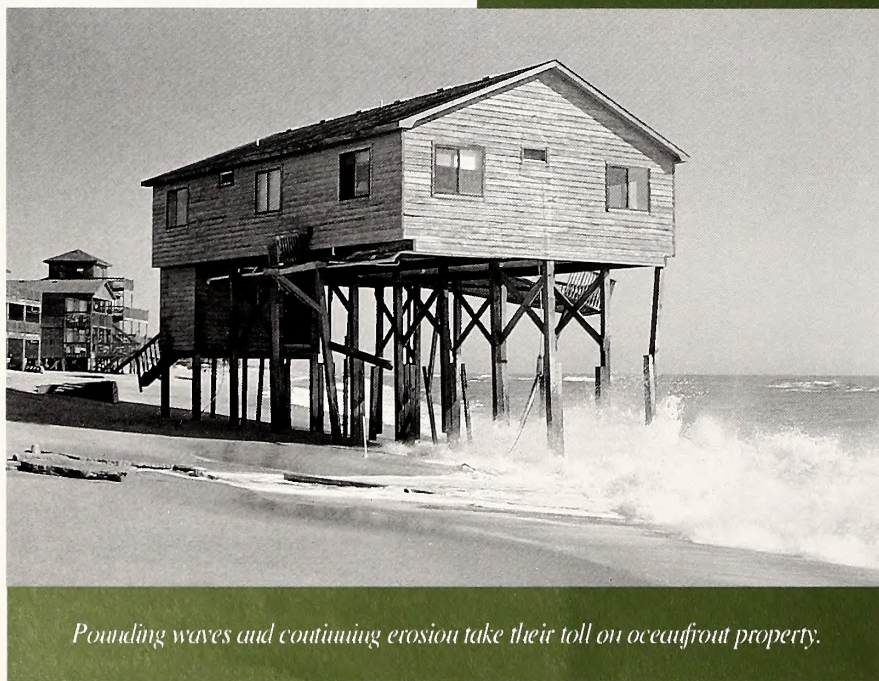
State Regulations, Local Planning

While CAMA affects all 20 coastal counties, state officials are careful to point out that state permit jurisdiction is only for "areas of environmental concern," or about 1 percent of the coastal landmass.



Estuaries, where fresh and salt water mix, are considered areas of

Scott D. Taylor



Pounding waves and continuing erosion take their toll on oceanfront property.

Spencer M. Rogers

"We don't have as big a stick as some people say," Jones says. But that 1 percent draws much attention, as it includes miles of sandy beaches and acres of marshland. "We have authority over some of the most environmentally sensitive and most expensive properties," he says.

"The philosophy of CAMA is not to stop development but to regulate it," Jones says. Powerful hurricanes in 1996 — Bertha and Fran — showed that setback requirements minimize storm damage, but can't eliminate it, he adds.

Even after a storm, the desire to build on the oceanfront is strong, with property owners checking the setback requirements based on the historical rate of erosion. "They ask, 'Where can I



environmental concern.

build?" Then they go to the minimum line," Jones says.

Spencer Rogers, coastal engineering specialist for North Carolina Sea Grant, says that the state was at the forefront of ocean-hazard management by considering both long-term erosion and single-storm effects.

North Carolina pioneered a joint permit process that consolidates federal and state applications. "It is all one house, one review process," says Rogers, who serves on the advisory council with Fuller.

CAMA also provides local permitting officers. Routine requests that could take three months and a consultant's assistance in Florida often are completed in a few days here, Rogers says.

One of CAMA's best-known regulations — a ban on seawalls and other hardened structures along the oceanfront

— was added by the CRC in 1985.

"The ban is absolutely critical. That is why we have nice sandy beaches," Moffitt says.

Eugene Tomlinson, CRC chairman, agrees. "I am proud that the commission, to this point, has held that line," he says. The state only allows exceptions to preserve historical structures and crucial roads.

"The ban on seawalls on the oceanfront is probably the biggest positive contribution of CAMA," Miller says.

Community leaders recognize the value of oceanfront regulations. But nature does not always follow an expected course, and communities must look for solutions.

"No one predicted the degree of erosion," Kirkman says, citing current problems from Pine Knoll Shores to Emerald Isle on Bogue Banks, areas developed after CAMA was in place. "In two or three years, large structures could be threatened if we don't do something," he adds.

This year, the CRC will review recommendations from the Coastal Hazard Science Panel, which includes Rogers and other Sea Grant researchers. The panel looked at historical data and geological features of specific sections of the coast.

Sandbags have been permitted in some areas as an emergency solution to erosion problems. But CRC rules limit the time bags can be exposed.

Beach nourishment, pumping sand back onto the shoreline, is expensive. Questions remain as to who should pay for such projects: oceanfront property owners, counties that benefit from property taxes and tourism the beachfront properties generate, or the state. "We need an overall state program on nourishment," Fuller says.

C o n t i n u e d



North Carolina beaches draw visitors from around the world.

Scott D. Taylor

CAMA not only sets state regulations; it also requires local land-use plans. The plans are crucial to some development proposals, as the state cannot grant a permit that would conflict with a local land-use plan. Also, federal permits must meet state and local consistency criteria.

Stick, the former CRC chairman, wrote a handbook for public participation in land-use planning because he saw too many communities use static plans. "The land-use plans are the key to the whole thing," Stick says.

Counties are required to have plans in place, but towns and cities are not. Local enthusiasm for the plans varies, and the CRC is reviewing the process. "Some use land-use planning as a sophisticated tool to implement their vision," Jones says.

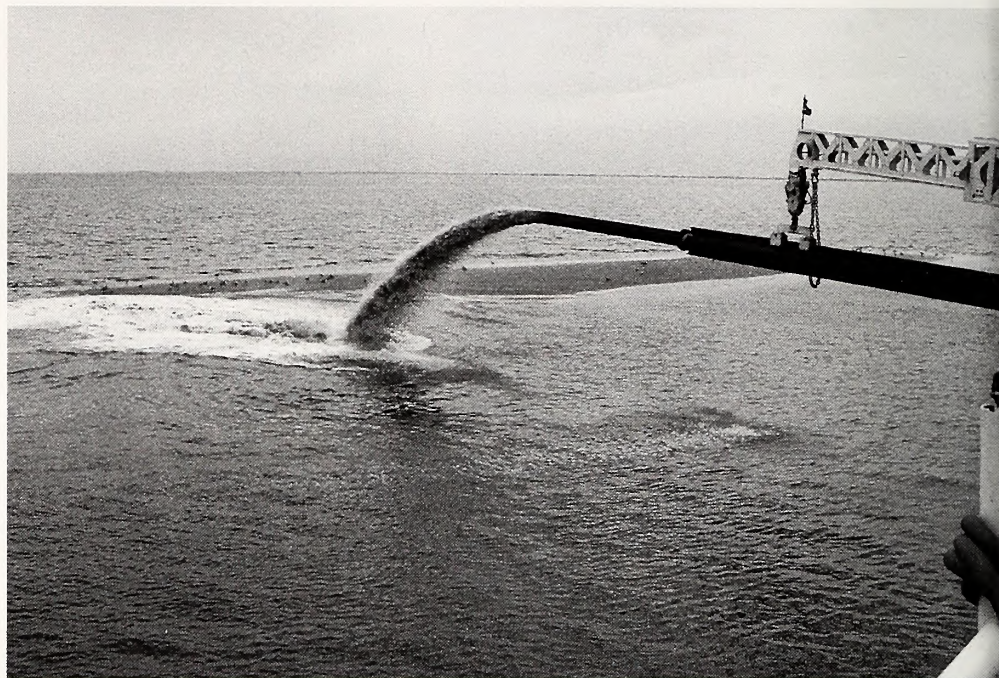
Other communities simply meet the state standard, then let the plans gather dust. "They don't have a lot of day-to-day impact on the growth and development of a community," Kirkman says.

For example, eastern Carteret County has no zoning in communities along Core Sound. While fishing families have much to lose if pollution diminishes water quality, these communities are skeptical of government regulation, Kirkman says.

Beach Access, Reserves Added

State officials love to speak of successful CAMA programs, such as the beach access and coastal reserve programs. "We've had success in non-regulatory areas that we don't get a whole lot of credit for," Jones says.

The ocean has always been considered a public resource, but as



Some coastal projects include the movement of sand.

Division of Coastal Management

beachfront property became more valuable, access became more difficult. The state initiated a grant program to encourage communities to purchase strips of land and build public walkways over dunes.

"We have such a tradition of the public being allowed to use our beach resources," Moffitt says. The 230 access points often have parking and restroom facilities, even an outdoor shower. Orange and blue signs mark the access points — and remind visitors of the CAMA connection.

The state is also fighting a lawsuit filed by Currituck County property owners, who dispute the tradition of a public right-of-way along the sandy beach from the first line of vegetation to the high-water mark. "We will continue to ensure that the public has access to the beaches," Moffitt says. If the state loses the suit, visitors may not be able to walk along the beach at high tide

without going on private property. "It would be a huge negative impact on tourism," she says.

CAMA also established a system of estuarine reserves, including Buxton Woods and Bald Head Woods in 2,000 acres of maritime forest. "We are able to preserve those areas — the ultimate preservation is to purchase it," Jones says.

The reserves are designed for education and other low-impact uses. The state plans a ninth reserve in Tyrrell County. The site, which will double the acreage in the reserve system, includes one of the last stands of Atlantic white cedars.

Challenges Ahead

What of the next 25 years of coastal development?

"The challenges for the future are immense," Moffitt says, citing a need for developments that are both environmen-

tally sensitive and aesthetically pleasing. Other challenges include protection of commercial fishing as a livelihood, efforts to minimize loss of life and property from storm damage, and erosion control.

Miller says CRC appointments are crucial. "The most critical and fragile coastal resources have received added protection from the program, but their long-term protection is uncertain," he says.

Fuller says the CRC focus has shifted from planning to regulating. "The rules that served us well in the last 25 years may not serve us well for the next 25 years," Fuller says.

Stick wants local governments to



Sandbags are considered emergency measures available only for a limited time.

Spencer M. Rogers



CAMA promotes protection of coastal resources through sustainable development.

Michael Halminski

utilize the existing structure to influence state decisions. "My main disappointment is there is too little direct contact between elected officials and their representatives on the advisory council and the CRC," he says.

To guide future development, Kirkman supports the creation of a Sustainable Coast Corporation to promote environmentally sound development in coastal counties. The independent nonprofit corporation would be insulated from political pressures, he says. It would coordinate technical data from universities and other sources.

Tomlinson, the CRC chairman, wants North Carolina beaches to remain an alternative to Virginia Beach and Myrtle Beach. "My greatest concern is that we are going to develop beyond our capacity to support," he says.

The commission, he says, must continue its course to promote coastal projects that are "safe, sensible and sustainable." ☐

THE
CATCH

Happy Sails to You:

*Stay Safe
on the
Water
this
Summer*

By Renée Wolcott Shannon



In summer, there are more people on the beaches and in the water than ever, but it isn't the best time of year for catching fish. "You can catch pompano, Spanish mackerel and king mackerel in summer," says Bob Hines, North Carolina Sea Grant fisheries agent. But spring and fall are the best times of year for fishing.

So what's a fisher to do during the long, hot summer days? Many still take

to the water. A love for fishing and a love for boats often go hand in hand. And being prepared for a safe, successful sail or an exhilarating spin across the bay in a fast motorboat is just as important — if not more so — than being prepared to reel in the big one.

In 1998, the N.C. Wildlife Resources Commission (WRC), which shares responsibility for enforcing boating safety regulations with the U.S.

Dave Brenner, Alaska Sea Grant

Coast Guard, reported 251 boat accidents; 35 people were killed. And more boat-related accidents occur in June, July, August and September than in the rest of the months combined.

"Accidents happen, but almost all of them are preventable," says Lt. Michael Brogdanowicz, hunting and boating safety coordinator for the WRC. "Most fatalities aren't the result of fantastic crashes — somebody simply falls overboard or ends up in the water and drowns."

Lt. Brogdanowicz recommends wearing a life preserver or personal flotation device (PFD), keeping a sharp lookout and avoiding alcohol to reduce your risk of an accident. PFDs have the greatest impact on your ability to survive a boating crisis, and operator inattention is the number one cause of accidents, says Brogdanowicz. PFDs are now required when riding personal watercraft such as Jet Skis and Sea Doos.

And it may be tempting to drink on board your boat — many people's idea of a romantic cruise involves a glass of wine or a mug of beer at sunset — but alcohol mixes no better with seagoing vessels than with cars, and similar "drunk driving" laws apply. Even if the boat operator does not drink, intoxicated

people can prove dangerous to themselves or to the skipper. Alcohol use is the second leading cause of fatal accidents on the water.

Fishers and boaters should also remember that June 1 marks the beginning of hurricane season every year — and it isn't over until Nov. 30. During summer, it's especially important to keep an eye on the weather. Don't go out unless you are sure your boat can handle the wind and wave conditions predicted.

Once you are on the water, watch the clouds and the sea for danger signs. Rip tides can create high waves capable of swamping a boat, and fog or heavy rain can decrease visibility. The National Oceanic and Atmospheric Administration's Weather Radio reports are a must for safety-conscious boaters.

If you get caught in a thunderstorm, stay below decks if possible. Lightning and strong, gusty winds make for unpredictable and dangerous conditions.

Of course, hurricanes are many steps above your average summer thundershower. Every year, North Carolina Sea Grant fisheries agent Jim Bahen helps Wilmington residents get their boats out of the water when hurricanes threaten. "The problem is, nobody thinks about it until it's too

late," he says. "Once the weather service says a hurricane might swing in toward North Carolina, you've got a two-day window" in which to secure property.

And with so many new residents along the coast, Bahen says, many don't know what to expect when a hurricane hits. "We've got so many new people coming to the coast and buying boats — if they're from Topeka, Kan., or Boone, N.C., they don't know what goes on down here."

Bahen recommends taking care of your boat as early as possible when a hurricane is predicted. If you have a small craft, pull it out of the water and take it to high ground. "The best thing is to take a small boat off the trailer and fill it full of water," Bahen says. "Try to get it away from trees."

For larger boats, search out a "hurricane hole" that is protected from wind and strong waves. Anchoring in the lee of an island or in an enclosed, inland marina may help protect your vessel. Putting out extra anchors can also keep your boat from swinging dangerously or breaking loose and damaging others' property.

Brogdanowicz says boaters should stay clear of inlets in heavy weather and search out a sheltered spot with few structures or other boats around. You can't anticipate what will happen in a hurricane, he says. "You just don't take chances."

So pack your PFD along with your fishing poles this summer, and keep an eye on the weather. The North Carolina Sea Grant staff wishes you happy sails.

Free Boating Publications from North Carolina Sea Grant

- **Hurricane Preparedness Poster for Boaters** describes how to prepare small or large recreational boats for an impending hurricane. UNC-SG-86-08; poster.

Continued

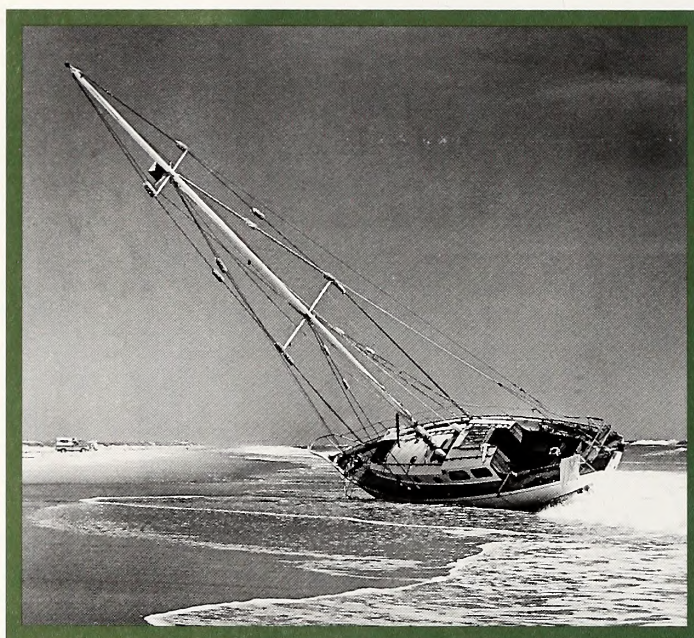


THE CATCH

- **Lightning and Boats** describes how to protect your boat from lightning using a method that directs electricity safely through the boat with less chance of damage or injury. UNC-SG-95-05; 12 pages.

- **Marine Distress Communications Form** provides step-by-step instructions for boaters and commercial fishers to broadcast distress calls during emergencies. UNC-SG-93-04; sticker.

To order these items, specify the title and publication number and mail to: North Carolina Sea Grant,



J. Foster Scott

NC State University,
Box 8605, Raleigh, NC
27695-8605, or call 919/
515-2454. □

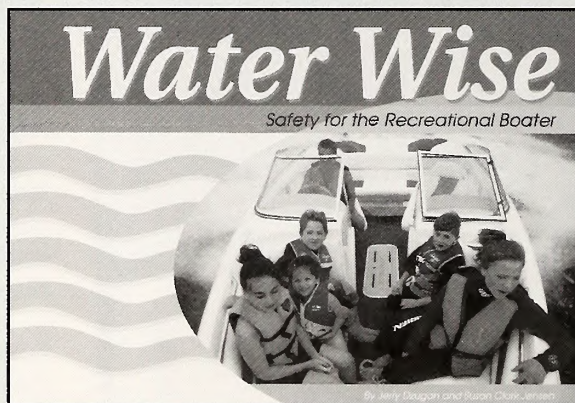
For more information on boating safety and North Carolina boating regulations, including those applying to personal watercraft (PWC), contact the enforcement division of the N.C. Wildlife Resources Commission at 919/733-7191. For information about free boating courses, call the boating education hotline: 800/336-2628.

STAY SAFE WITH WATER WISE

What would you do if your boat turned over far from shore? How would you keep warm? Should you swim for the beach or wait for help?

If you don't know the answers to these questions, pick up a copy of *Water Wise: Safety for the Recreational Boater*, by Jerry Dzugan and Susan Clark Jensen. Alaska Sea Grant and the U.S. Marine Safety Association have teamed up to publish this thorough, informative book on boating safety and accident prevention, and North Carolina Sea Grant has copies available.

Turn to *Water Wise* for concise, clear instructions on how to choose a personal floatation device (PFD),



how to prepare for a safe trip, how to gauge the weather and how to signal for help in an emergency. Chapters include "Alcohol, Fatigue, and Seasickness," "Surviving in the Water," "First Aid Afloat" and "Safe Seamanship."

Line drawings, photographs and tables illustrate each point, making this

a practical guide you'll turn to again and again. A resource list at the end of the book provides phone numbers and addresses for national and local boating organizations.

"Each year more than 78 million boaters take to America's waterways," the book says, "and according to the U.S. Coast Guard, as many as 800 die in boating-related accidents." Read *Water Wise* to improve your chances of avoiding accidents and surviving boat-related crises.

To order a copy, mail a check for \$12 to North Carolina Sea Grant, NC State University, Box 8605, Raleigh, NC 27695-8605. Write UNC-SG-99-05 in the memo line. □

— R.W.S.

Kids at the Beach

By Renée Wolcott Shannon

It's summer in North Carolina — time for packing up the kids and driving to the beach. On this trip, be sure to pack a sack full of books along with your sunscreen and sand toys.

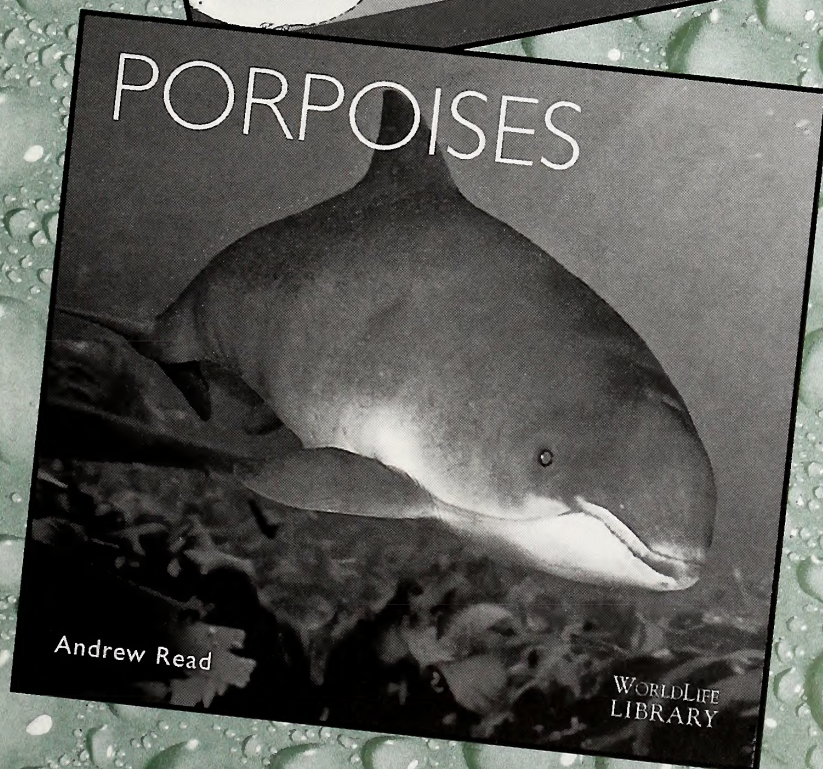
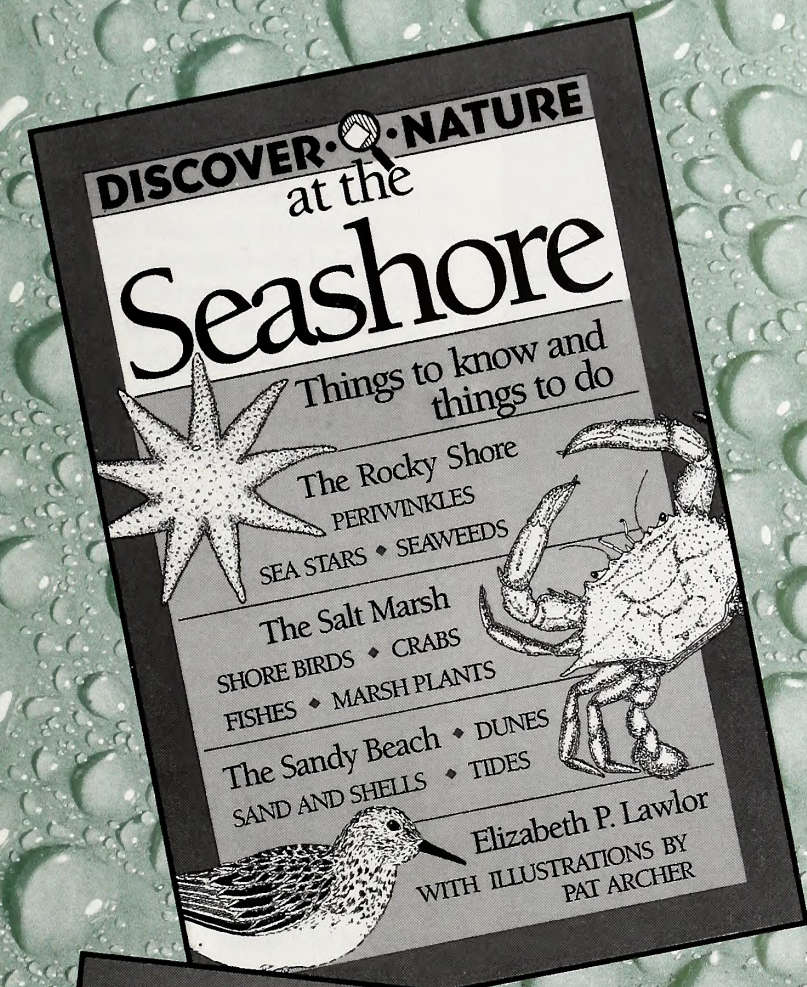
I have a pile of great reads to recommend — books chock-full of activities to keep kids busy, illustrations to make them wonder and words to make them listen. They'll learn a lot, too — about everything from poetry to porpoises.

So enjoy the sand, sun and surf, but don't forget these *Coastwatch* picks. Even if you don't have children of your own, these books will bring out the kid in you.

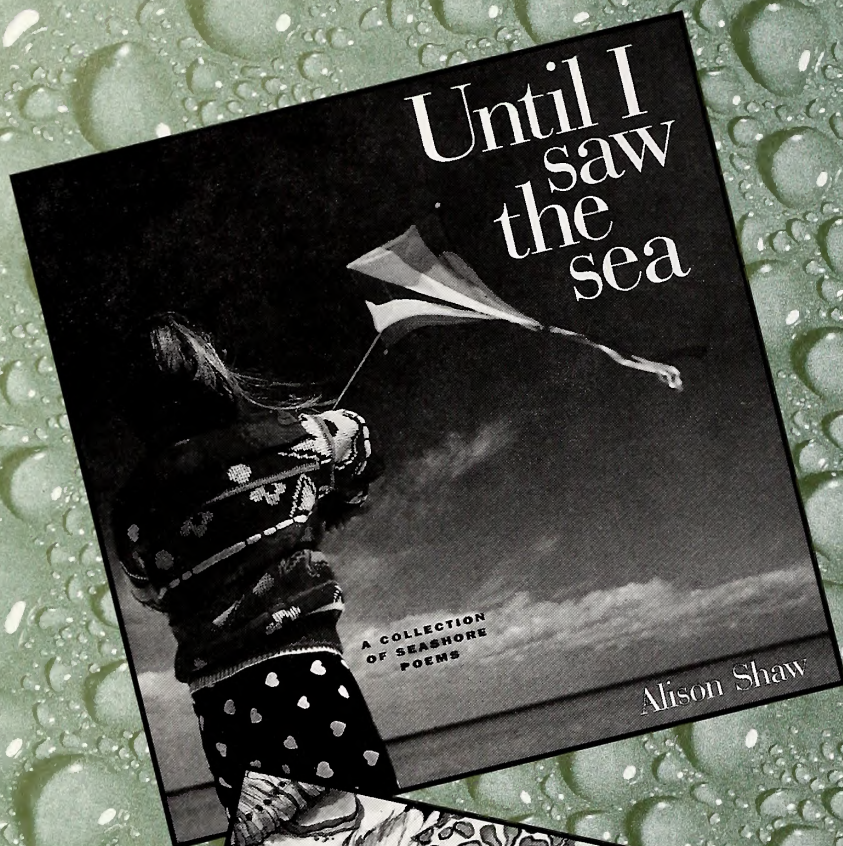
• *Discover Nature at the Seashore: Things to Know and Things to Do* by Elizabeth P. Lawlor, illustrated by Pat Archer. 1992. Stackpole Books, Cameron and Kelker Streets, P.O. Box 1831, Harrisburg, PA 17105. 211 pages. Paperback, \$14.95. ISBN 0-8117-3079-4.

Naturalists of all ages will enjoy this commonsense guide to exploring

Continued



BOOK MARKET



the various shoreline environments: the rocky intertidal, salt marsh and sandy beach. Lawlor, an associate professor of science education at Hunter College, New York City, suggests a basic kit of tools for investigating life along the shore and then plunges you into the fascinating secret lives of common marine plants and animals.

Her clear prose guides you through simple experiments and observations that focus on everything from barnacles and seaweed to fish and periwinkles, from sea stars and shorebirds to dunes and tides. She uncovers the ancient history of the horseshoe crab and follows the aggressive, fastidious fiddler crab through its cycles of hibernation, mating, resting and feeding.

Each chapter opens with an overview of a particular plant or animal and its habitat. The "Observations" section provides suggestions for studying the target organism and lists questions to focus on when taking notes. In "Explorations," Lawlor describes simple experiments that reveal even more about the habitats and the creatures who live there.

In the chapter on mud worms, Lawlor begins by illustrating marine worms' importance in the food chain. She goes on to describe several different species of common mud worms, including the paddle worm, parchment worm and blood worm.

The author asks you to dig up worms, examine them swimming and digging, and to search for eyes and "teeth." The "exploration" involves taking a worm's pulse.

This is a well-organized, informative book. Lawlor provides both common and scientific names for all

the species mentioned, includes lists of necessary tools and skills in each chapter, and suggests safe ways to handle and return the animals. Archer's detailed drawings, along with clear tables and diagrams, make *Discover Nature at the Seashore* a useful book for both budding scientists and long-time nature lovers.

• **Porpoises** by Andrew Read. 1999. WorldLife Library. Voyageur Press Inc., 123 North Second St., P.O. Box 338, Stillwater, MN 55082. 72 pages. Paperback, \$16.95. ISBN 0-89658-420-8.

Do you know the difference between a porpoise and a dolphin? You will, after reading this fact-packed book by Read, a Sea Grant researcher and Duke University Marine Laboratory scientist.

Read explains that porpoises, though related to dolphins, are from an entirely different family — the *Phocoenidae* — and that they are not as familiar to many people. Shy, elusive animals, they avoid contact with humans and rarely ride bow-waves or leap into the air like their acrobatic cousins.

Aided by glossy, full-color photographs, Read describes the six species of porpoise, including the harbor porpoise, Burmeister's porpoise, and the extremely endangered vaquita. He also details the life history of porpoises, noting their exhausting reproductive cycle among other facts — gestation lasts 11 months, and females often conceive again within six weeks after giving birth.

Other chapters cover porpoise behavior and ecology: what they eat, how they use their blubber and what their predators are. With his colleague Andrew Westgate, Read has also tagged and tracked porpoises, using retrievable data tags to measure how deep they dive.

Read closes with a discussion of porpoise conservation efforts and why they are necessary. Thousands of porpoises die in gill nets every year, and the vaquita may be near extinction. Luckily, some conservation programs are proving successful.

By the time you close this book, you'll know more about porpoises than you ever did before, and you'll have a new appreciation for the intelligent, social creatures roaming our ocean waters.

• **Until I Saw the Sea: A Collection of Seashore Poems** by Allison Shaw. 1995. Henry Holt and Company Inc., 115 West 18th St., New York, NY 10011. 32 pages. Paperback, \$6.95. ISBN 0-8050-5794-3.

Beach lovers and poem readers of all ages will love this bright, colorful book. Brilliant photographs of shells, boats and kids in primary colors — or nothing at all — accompany short poems that capture the salt and rhythm of the ocean.

Celebrate the sea with old favorites like John Masefield's "Sea Fever" — *I must go down to the seas again, to the lonely sea and the sky, / And all I ask is a tall ship and a star to steer her by ...* — and new ones, like Myra Cohn Livingston's "Seaweed":

*Seaweed from high tide
where sand and breakers meet
gummy
on my tummy,
slippery
on my feet.*

The large typeface and snappy colors make this a perfect match for young readers, and parents can use the photographs to help very small children with their colors.

With everything from e.e. cummings to traditional ocean lullabies, this eye-catching book is a real seaside treasure.

• **An Island Scrapbook: Dawn to Dusk on a Barrier Island** by Virginia Wright-Frierson. 1998. Simon and Schuster Books for Young Readers, 1230 Avenue of the Americas, New York, NY 10020. 36 pages. Hardcover, \$16.00. ISBN 0-689-81563-8.

This beautiful book is a work of art from cover to cover. Wright-Frierson, who lives in Wilmington, is an outstanding illustrator as well as an author, and her gorgeous watercolors bring the pages to life.

An Island Scrapbook details a late-summer day spent on one of North Carolina's southernmost barrier islands — home to alligators, cabbage palms, pelicans and fiddler crabs. Wright-Frierson and her daughter Amy pack sketchbooks, pencils and paint and capture the island in all its glory.

The text is packed with details about the island habitat and its many denizens. Wright-Frierson evokes "the whispers of the rustling cordgrass, the lapping of the tide, the call of a clapper rail, and the skittering and claw-clicking of fiddler crabs." You can almost smell the sea.

Paintings chronicling a day on the island are interspersed with scrapbook-style pages from a naturalist's sketch pad, noting the effects of hurricanes, the shapes of dolphin and shark fins, sea turtles' foods and the look-alike litter that endangers them. As you join Amy and her mother on their explorations of the mudflats, maritime forest and beach, you'll also learn a lot about loggerhead nests, ocean pollution, marine conservation and the animals that make the seashore their home.

Recently, *An Island Scrapbook* was named to the highly acclaimed John Burroughs List of Nature Books for Young Readers. It will make a treasured addition to any beachcomber's bookshelf, keeping the spirit of the sea alive long after summer is over. ■



David Eggleston's blue crab research offers a new understanding of how hurricanes benefit crab crops.

Blue Crabs:

Study Reveals New Secrets

By Ann Green

Just one day after Hurricane Fran ripped through the salty, shallow marshes of the Pamlico Sound, North Carolina Sea Grant researchers David Eggleston and Lisa Etherington stumbled upon peat beds packed with juvenile blue crabs.

By discovering the crabs inshore in peat beds composed of old plant material,

Eggleston and Etherington identified an unknown nursery habitat for early juvenile crabs. In normal weather, juvenile crabs don't settle inshore but inhabit the seagrass beds along the sound side of the Outer Banks.

"You only see pulses of crabs come inshore after a hurricane or a tropical storm," says Eggleston, an assistant

professor of marine sciences at NC State University. "The hurricane's winds drive the crabs toward the western shore of the Pamlico Sound and into the Croatan, Albemarle and Currituck sounds. We usually have bumper crops of juvenile crabs after hurricanes."

After Hurricane Fran, Eggleston and Etherington, an NC State graduate student

and a Sea Grant fellow, also found a large number of juvenile blue crabs in an exotic species of submerged grass in the mouth of the Albemarle and Currituck sounds behind Kitty Hawk. The thick, bushy grass, called Eurasian water-milfoil or *Myriophyllum spicatum*, grows so fast that it can be a nuisance for boaters.

"These alternative nursery areas mainly blink on after hurricanes," says Eggleston. "They have the potential to increase the nursery capabilities of the entire sound system."

The Eurasian grass also serves as a habitat for finfish, including the juvenile red drum. "Red drum, which is fished almost exclusively by recreational fishers, has been overexploited," he says.

However, the most critical habitat for juvenile crabs is sea-grass beds along the sound side of the Outer Banks. The beds consistently receive post-larval crabs during stormy and non-stormy periods.

Eggleston says these nursery grounds — which are vital to fishery health — are vulnerable to human impact and must command a high priority in terms of conservation. "They can be threatened by leaking septic waste from soundside development and by Jet Skis and small boats cutting through them," he says.

These findings are part of Eggleston's ongoing blue crab study. With initial funding from Sea Grant, he began a large study of recruitment of juvenile blue crabs in North Carolina more than four years ago. The N.C. Division of Marine Fisheries, National Science Foundation and Z. Smith Reynolds Foundation have also supported his research.

Although the hurricanes may offer a bounty of crabs, there are other concerns about the health of the blue crab fishery. Eggleston has studied overfishing in the Pamlico and Albemarle sounds as well as habitat changes from building jetties outside Oregon Inlet.

Eggleston found that blue crab harvests in the Pamlico and Albemarle

sounds are at or above sustainable limits and should be capped or cut back to protect the fishery's continued health and productivity.

"During the past three years, crabbers have harvested between 54 and 67 million pounds a year in our sounds," says Eggleston. "Based on our research, which includes an analysis of multiple sets of N.C. Division of Marine Fisheries crab-harvest data dating back to 1972, we calculate the maximum sustainable yield at between 48 and 60 million pounds."

As oyster, flounder and other species become overfished, more fishers are turning to blue crabs, Eggleston says. "No one wants to deny anyone this right. However, if blue crab harvests continue to exceed sustainable levels, the long-term outlook for the fishery may be a concern."

Blue crabs are North Carolina's top commercial fishery species, worth about \$40.5 million in 1998, according to the N.C. Division of Marine Fisheries. About 800,000 crab pots are fished on the sounds each year. The season traditionally runs from March to November.

In 1994, the N.C. General Assembly issued a moratorium that placed a temporary cap on commercial crab licenses through July 1999. Legislation that extends the crab moratorium to October 2000 passed the General Assembly in June.

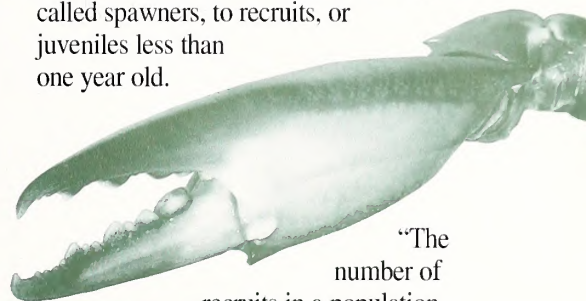
This year, the Division of Marine Fisheries will come up with a new plan for managing the number of fishers and gear in the blue crab fishery, Eggleston says.

In May, the Marine Fisheries Commission adopted several temporary rules for crab harvest and created management regions for the blue crab fishery.

"The Marine Fisheries Commission's regional advisory committees will be developing effort-management options for North Carolina's diverse crab fishery prior to October 2000," says Nancy Fish, spokesperson for the Division of Marine Fisheries.

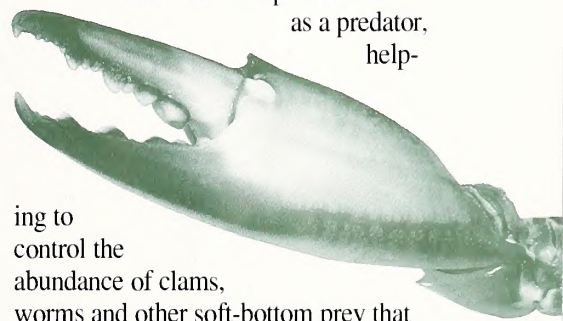
One factor critical to the health of blue

crab stock is the ratio of adult females, called spawners, to recruits, or juveniles less than one year old.



"The number of recruits in a population depends in large part on the number of spawners," Eggleston says. "The more spawners, the more recruits. At too-low population densities, the overfished population begins to lose its ability to build itself back up."

Such a decline would affect the blue crab's important role as a predator, help-



ing to control the abundance of clams, worms and other soft-bottom prey that live in the sand or mud.

In his research, Eggleston also found that Oregon Inlet is a critical ocean-to-estuary link through which millions of post-larval crabs enter the North Carolina sounds.

"We need to be careful about possibly altering water exchange through this vital link," he says. "Recent proposals to build jetties outside the inlet would be great for boating and fishing, but the impact on crabs is unclear. Jetties may actually enhance the transport of crabs from offshore into the sound or they may reduce transport or have no effect at all. We need further study before we build jetties."

To get the most up-to-date information on Eggleston's blue crab research, visit the Web at http://www2.ncsu.edu/eos/info/mea/mea469_info/bluecrab/. □

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WINGS
OVER WATER

From the Editor

Autumn Arrives

In North Carolina, the shift from summer to fall tends to be subtle. September and October are still prime months for beach visits before the first chill hits.

But there is a hint of change in this autumn issue of *Coastwatch*. We are adding *Legal Tides* to the list of topics that fill our back pages.

Legal Tides is new to *Coastwatch*, but it is not new to North Carolina Sea Grant. For 13 years, Walter Clark, our coastal law and policy specialist, has edited the *Legal Tides* newsletter. In its pages, Walter and guest writers from around the state offered perspectives on court decisions, legislation and regulations that affect our coast.

Many law and policy issues — such as proposed estuarine shoreline regulations or water-use zoning — have been topics for *Coastwatch* articles. We are incorporating *Legal Tides* into *Coastwatch* in order to reach a larger audience.

We have made other adjustments to be more cost-effective. For example, we are using a lighter paper for our magazine cover — but you can be sure the high-quality content in *Coastwatch* will remain.

North Carolina Sea Grant publications continue to grab top honors. Our publications received two Awards of Excellence in the 1999 Awards for Publication Excellence (APEX) from Communications Concepts Inc.

Coastal Water Quality Handbook was honored in the instructional publication category. Sea Grant specialists Barbara Doll and Lundie Spence wrote the handbook, which



was edited by Daun Daemon and Renée Wolcott Shannon and designed by Kathy McKee.

The Spring 1999 issue of *Coastwatch* received an APEX award for magazine writing. *Coastwatch* also received the "People's Choice" award for best magazine at Sea Grant Week 1999, a national meeting held in Portland, Ore.

We continue efforts to widen our *Coastwatch* audience. Each new reader gains insight into our coast and the North Carolina Sea Grant mission — and each new subscription offsets our costs a little more.

A new brochure that introduces *Coastwatch* to potential readers is available in many state parks and visitors' centers along the coast. The magazine is also available in a number of bookstores. *Coastwatch* has been a hit among tourists and locals alike.

But our greatest opportunity to share the coast with others comes from you, our readers, who pass the magazine on to friends and family. New subscribers often first see the magazine on a friend's coffee table. Others receive it as a gift.

As Renée, Ann and I begin our second year with Sea Grant and *Coastwatch*, we look forward to maintaining the standard of excellence that has been a Sea Grant tradition.

I invite you to sit back for an autumn trip to the North Carolina coast. Catch a wave with surfers on the Outer Banks. Uncover the mysteries of fall migration at the Wings Over Water festival. And visit a flounder-fattening farm in Cedar Island.

Enjoy your trip. ▣

Katie Mosher, Managing Editor

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Finding Feathered Friends in Eastern North Carolina

Every autumn, flocks of migrating birds settle in North Carolina's ponds and pocosins, making the eastern part of the state a hot destination for bird-watchers and other naturalists. These out-of-season tourists enjoy breathtaking wildlife while they bolster the local economy. Join Renée Wolcott Shannon on a three-day bird-watching, kayaking, bear-sighting exploration as part of the annual Wings Over Water celebration. 6

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Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports several research projects, a 12-member extension program and a communications staff. Ron Hodson is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina. *Coastwatch* (ISSN 1068-784X) is published bimonthly, six times a year, for \$15 by the North Carolina Sea Grant College Program, North Carolina State University, Box 8605, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095.

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by Scott D. Taylor.

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by Michael Halminski.

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COASTAL TIDINGS



Nickens at the Belhaven Museum

Coastwatch Live: An Evening with Eddie Nickens

If you enjoyed "The Hook," T. Edward Nickens' account of life on Cape Lookout, or "The Big Ditch," his story of a three-day journey down the Intracoastal Waterway, get out your calendar. On Nov. 16 at 7 p.m., Nickens will read from his award-winning *Coastwatch* series for a Friends of the Library event at NC State University.

In his talk, "Cape, River, Inlet, Sound: Where History Meets the Sea," Nickens will revisit North Carolina's historic coastal landmarks. In addition to "The Hook" and "The Big Ditch," Nickens' stories for *Coastwatch* spotlighted the controversial history of Oregon Inlet, surf fishing at Cape Hatteras, market hunting on Currituck Sound and, most recently, the history of the Cape Fear River.

A High Point native now living in

Raleigh, Nickens has written about natural history for 15 years. In 1998, he won five national writing awards presented by the Outdoor Writers Association of America, including the "best of the best" award for the year. Two of his *Coastwatch* articles placed in the competition. Nickens is currently at work on a book outlining the history of wildlife in North Carolina.

Nickens' reading, which is free and open to the public, will be held in the second floor assembly room of the D.H. Hill Library on the NC State campus.

For more information about the reading or to join Friends of the Library, call 919/515-2841; write to the Friends of the Library, NCSU Libraries, Box 7111, Raleigh, NC 27695-7111; or visit the Web site at www.lib.ncsu.edu/libraries/administration/foll.

—R.W.S.

In the Next Issue of *Coastwatch*

With the year 2000 on the horizon, the next issue of *Coastwatch* will take a look at both the past and the future of life and science along the coast. How has life changed for commercial fishers and fishing villages over the centuries? And glimpse the future of marine science as you join young researchers from Manteo High School on a field expedition.

Increased Atmospheric Nitrogen Parallels Harmful Algal Blooms

Over the last three decades, the amount of atmospheric nitrogen polluting North Carolina waters and other parts of the North Atlantic Ocean Basin has increased significantly and parallels harmful algal blooms, according to a new study.

North Carolina Sea Grant researchers found that nitrogen in the air accounted for 46 to 57 percent of the total nitrogen newly deposited in the nitrogen-sensitive North Atlantic Ocean Basin. The increase can be attributed to growing agricultural, urban and industrial emissions of nitrogen oxides and ammonia, and possibly organic nitrogen.

"The study is significant because it reconfirms that atmospheric nitrogen has been found to be a regional and global source of pollution," says Hans Paerl, North Carolina Sea Grant research scientist and Kenan professor of marine and environmental sciences at the University of North Carolina at Chapel Hill (UNC-CH) Institute of Marine Sciences.

"We also found a strong spatial linkage between water in areas with high amounts of atmospheric nitrogen and in places where there have been documented increases in harmful algal blooms. This is critical as we are only beginning to understand the importance of links between human-induced pollution of coastal oceans and harmful algal bloom expansion."

David Whitall, a UNC-CH graduate student, collaborated with Paerl on the report, published in the journal *Ambio*.

When algal blooms decompose on an ocean or river bottom, they use up oxygen in the water. If waters become anoxic — having no dissolved oxygen — then the fish and shellfish can die. Certain toxic or inedible bloom species can alter the food webs on which all commercial and sportfishing species rely.

In North Carolina, researchers found that increased atmospheric nitrogen in coastal waters reflects changing land use and human activities. One of the most prominent land-use changes has been the rapidly growing swine and poultry industry in the mid-Atlantic coastal plain, says Paerl. The industry's growth has prompted an increase in atmospheric nitrogen in the form of ammonia from animal waste, storage and land application.

"Ammonia is the most preferred source of nitrogen for many algal species, including harmful forms," says Paerl. "We are closely examining the linkage between enhanced ammonia deposition and the potential for harmful algal bloom expansion." — A.G.

New Fishing Licenses Instituted

If you ever use a gill net or a shrimp trawl to catch food for your family, you need a new license from the Division of Marine Fisheries (DMF) to fish legally. Recreational fishers who use commercial gear — though they do not sell their catch — are now required to buy a Recreational Commercial Gear License (RCGL) for \$35. If you don't have one yet, act quickly: the grace period for the old license expired Aug. 1.

The RCGL is just one part of a DMF system that introduces 12 new licenses this year, including the Standard Commercial Fishing License (SCFL) for most commercial fishers, a shellfish license and spotter plane license. The new license system is a requirement of the 1997 Fisheries Reform Act and allows the division to assess the impact of fishing activities more accurately.

Under the new system, only fishers holding a valid Endorsement-to-Sell are eligible to purchase an SCFL. An additional 500 commercial licenses may be distributed to persons meeting established criteria, including past involvement in or reliance on commercial fishing.

Most licenses are available from DMF regional offices. The RCGL is also available from Wildlife Resources Commission license agents throughout the state for an additional charge of \$1. For more information about the new licenses, visit the division's Web site at www.ncfisheries.net/license/index.html or call Nancy Fish at 252/726-7021.

— R.W.S.

Journey's End

Photo by Michael Halminski

Autumn visitors to the Outer Banks will once again see the beacon of the historic Cape Hatteras lighthouse. The massive lighthouse was rolled 2,900 feet along a temporary rail system, ending its journey July 9. Although the beacon returned on Labor Day weekend, visitors must wait until Memorial Day 2000 to venture inside. Workers continue to secure the foundation at the new site.



Celebrate the Sounds

Kayak and canoe racers and folks who simply love North Carolina's sounds will gather Nov. 6 - 7 for the second annual Sound Country Celebration in Edenton.

The festival promotes the natural and cultural resources of the coastal plain. Participants can enjoy races, educational programs and displays, local crafts, food and music. Proceeds benefit community projects.

"We did so well, even with the rain last year, that we are supporting the building of a canoe and kayak platform at the waterfront in Edenton," says organizer Peter Bogus.

The East Coast Championship Canoe and Kayak Races will showcase the top 125 racers from New England to Florida. For those who are less competitive, there are recreational races and a challenge for business teams.

For a leisurely pace, interpretive canoe outings also will be offered. Visitors can bring their own canoes or borrow one for the nature program.

For more information on race registration, check the Web at www.edenton.com and follow the events link to the Sound Country Celebration page or call 800/775-0111 or 252/482-2282. — K.M.

Lighthouse's Rich History Inspires New CD

For more than 100 years, the Cape Hatteras lighthouse has stood strong as an important North Carolina coastal landmark.

As waves began to crash at its spiral base, the lighthouse inspired a fierce debate on erosion-control efforts. This summer, despite heavy opposition, the lighthouse was moved about a half-mile inland.

The landmark's move and its rich history inspired NC State University adjunct music professor Bett Padgett to produce a new compact disc: "Hatteras: If a Lighthouse Could Speak."

"The folkish-style CD speaks of the emotions felt by the local people toward

relocating the lighthouse," says Padgett, who teaches guitar lessons at NC State. "It also tells of the importance of saving the lighthouse. I have traveled in Europe and visited their castles and homes. Europeans have worked hard to preserve their history and culture. Americans also need to preserve historic structures like the lighthouse."

The CD, produced by Red Eye Distributors, can be found at book and record stores throughout North Carolina or ordered on the Web at bettpadgett.com. Half of the profits will be donated to the Cape Hatteras National Seashore. — A.G.

Recycled Chickens Make Safe, Effective Crab Bait

A chicken farmer's trash may soon be a crabber's treasure. North Carolina Sea Grant researchers report that a poultry-based bait set with a heat-binding system is safe and effective as an alternative bait for harvesting blue crabs.

The fermented "poultry mortalities," or dead chickens, may prove useful as an alternative bait for other aquatic species caught by trap, including lobster, eel and sea bass.

"People have been using chicken parts to catch crabs for many years," says North Carolina Sea Grant researcher Peter Ferket, who is associate professor of poultry science at NC State University.

"By heat-treating the chicken, we have eliminated salmonella, E-coli and other bacteria. The chicken bait could be safer than natural baits that may be contaminated with harmful bacteria."

This study confirmed earlier Sea Grant tests of the experimental crab bait, which takes advantage of food-science technology.

Traditionally, crabbers have used fish bycatch, river herring and menhaden for bait. In North Carolina, some traditional bait sources are no longer viable. Because of improved technology and

state and federal regulatory efforts to reduce catch that is undersized and unmarketable, bycatch has declined. Also, the landings of river herring declined 87 percent from 1985 to 1994, according to the N.C. Division of Marine Fisheries.

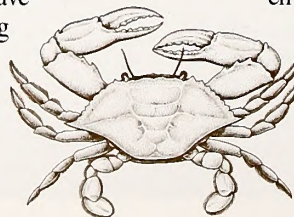
"Because of competition for alternative uses of menhaden such as fish meal production, prices for menhaden have increased 55 percent in the last three years," says Bob Hines, North Carolina Sea Grant fisheries specialist.

Teena Middleton, who received her Ph.D. from NC State in 1999, collaborated with Hines and Ferket. Their findings also show that no off-flavors are produced in crabs harvested using the new bait.

The poultry-based bait may be cost-effective for both crabbers and farmers.

"In North Carolina, 50,000 tons of poultry mortality is disposed of every year," says Ferket. "We are trying to take a material that has traditionally been an

environmental negative and use it to produce a product that benefits the poultry industry and blue crab fishery. However, additional research is needed on the optimum durability of the bait." — A.G.



Columbia Theater: Glimpses of the Past

Inside an old movie theater in Columbia, Hunter Jim gives folks an earful about the abundance of fish and wildlife in Tyrrell County.

Dressed in a plaid shirt, khaki pants and an orange hunting cap, Hunter Jim nods

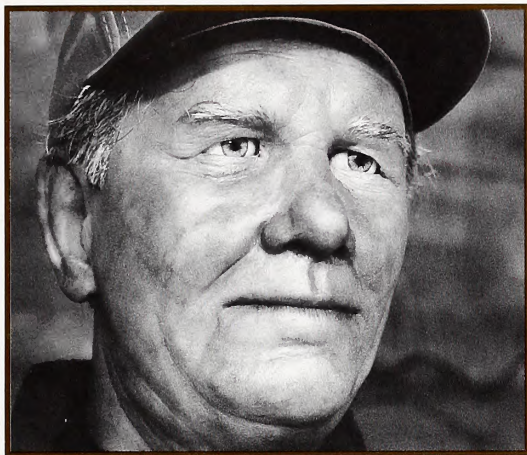
and smiles as he greets each visitor to the Columbia Theater Cultural Resources Center.

"So what brings you out this way, stranger?" asks Hunter Jim. "Don't often see people out in the woods this far. You hunting, fishing or just enjoying the scenery? Doesn't matter much, they're all great here in Tyrrell County. There's something special about this part of the world — we got all the woods, water, wetlands and wildlife you could want, so it's a paradise if you like to get outside."

Although Hunter Jim seems human as he talks, blinks and moves his eyes, he is actually a fully animated robot donated by the U.S. Fish and Wildlife Service.

With his colorful accent and sharp memory about Tyrrell County traditions, Hunter Jim is the featured attraction at the resource center in downtown Columbia. Two floors of the restored theater are filled with donated artifacts that highlight human uses of the Albemarle-Pamlico region's resources. Opened in October 1998, the facility is operated by the Partnership for the Sounds.

Helen Craddock, administrator of the Columbia Theater, distinguishes the facility from the North Carolina Estuarium, also operated by the partnership. "The estuarium focuses on ecosystems, in contrast to the theater, which



Hunter Jim greets visitors.

focuses on the human interaction with the environment," she says.

To showcase Tyrrell County's strong farming tradition, a variety of relics — from a 20-gallon stone butter-churner to

natural underwear — offer a glimpse into the hard life of people who worked the land. There is also a variety of kitchenware used before World War II — from cast-iron utensils to heavy cookware.

Wander upstairs to find artifacts from the shipwreck of the *Estelle Randall*, including glass bottles and a clock. The ship sank and burned in 1910 while docked in Columbia. For war buffs, there is a small military display with a Korean War infantry uniform and a Christmas card from a soldier in World War II.

To recreate the atmosphere of an old movie theater, the downstairs exhibits look like movie sets with backdrops and directors' chairs. In the forestry exhibit, youngsters can practice sawing a plastic log. The "To Catch a Fish" set includes an old shad-boat mast and herring dip net. The farming exhibit features an old potato grader used by countless generations to sort potatoes.

"We raise a lot of Irish potatoes in Tyrrell County," says Craddock. "It's a rite of passage for children to work on a potato farm."

Columbia Theater Cultural Resources Center, 304 Main St., Columbia, is open Tuesday through Saturday from 10 a.m. to 4 p.m. Admission is \$2 for adults, \$1 for children 5-17. For more information, call 252/766-0200. — A.G.

Corrosion Lurks in Salt Spray

Long before you see the ocean, you begin to taste the hint of salt in the air. But coastal property owners should know of the corrosive effect salt has on buildings.

"Salt spray is tossed into the air by breaking waves," says Spencer Rogers, North Carolina Sea Grant coastal engineering specialist.

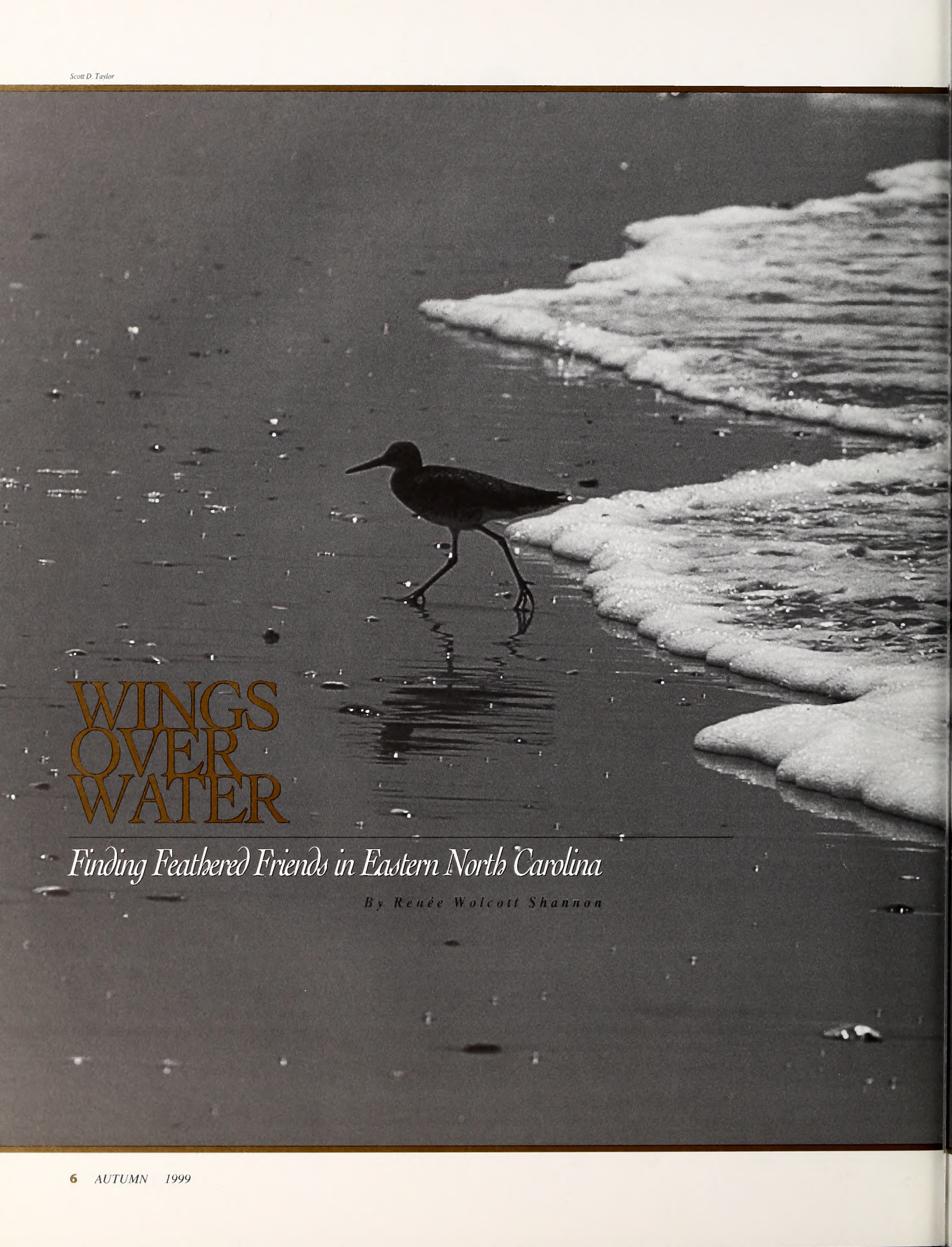
While erosion, storm surges and wind damage may get more attention, corrosion can wage a subtle but expensive war on metal connectors. Corrosion is greatest on first-row houses, but some effects are found a mile away.

"Corrosion engineering is often not intuitive," Rogers says. Corrosion-resistant sheet metals may be selected during construction at limited additional cost. Protective coatings can be added to existing metal connectors.

Need specific information? Rogers worked with the Federal Emergency Management Agency to develop a technical bulletin offering tips to safeguard coastal homes.

For a free copy of *Corrosion Protection for Metal Connectors in Coastal Areas*, FEMA TB-8-96, call Rogers at 910/256-2083. Copies are also available on the Web at www.fema.gov/MIT.techbul.htm. The FEMA hotline is 800/480-2520.

— K.M.



WINGS OVER WATER

Finding Feathered Friends in Eastern North Carolina

By Renée Wolcott Shannon





Bird-watchers scan the skies at Wings Over Water.

I'M KAYAKING

across Milltail Creek in an open-topped yellow kayak, dripping water all over my jeans and trying to keep my camera dry. I am not a bird-watcher. I can identify cardinals and blue jays, sparrows and crows, robins and mourning doves — the avian residents of my suburban neighborhood — and that's about it. Here at the Wings Over Water bird-watching festival, I'm definitely in a minority.

Other brightly colored plastic vessels dot the surface of the pond. I'm surrounded by people in winter coats with binoculars strapped around their necks. They're here to see wood ducks, pileated woodpeckers and great blue herons. I'm here to enjoy the clear, cold autumn weather, to see a few birds for myself, and perhaps to figure out what has drawn my companions from across the country.

This morning at the opening break-

fast, keynote speaker Ken Kaufman described his lifelong love affair with birds, a fascination that began when he was 6 years old. After he graduated from college, he hitchhiked for several years, looking for birds all over North America. Birds seem so free, he says, and people have always been attracted to them for that reason. Yet they aren't as free as they appear — even as they cross borders and continents with ease, they follow strict schedules and predictable routes.

Serious bird-watchers arrive armed with information about the birds they're likely to find. Many of them can identify more than 200 birds by sight. They're here for the love of the chase, building "life lists" that keep track of all the species they've ever seen.

The Outer Banks are a hot spot of feathered activity in early winter, when the birds are migrating, and Wings Over Water banks on that fact.

BIRD-WATCHING is a big business. Jack Thigpen, North Carolina Sea Grant's coastal recreation and tourism specialist, says estimates show that birders pump billions of dollars into the national economy. Local communities also benefit from bird-watching festivals, and Wings Over Water is the result of a partnership of sponsors who want to bring responsible, sustainable development to coastal North Carolina.

Mike Bryant, manager of the Alligator River and Pea Island National Wildlife Refuges, hatched the idea of a festival to celebrate the

wetland-dependent birds that flock to the coastal plain every fall. He brought the idea from Texas, where ecotourism events — including a birding festival — brought more than \$13 million a year to the lower Rio Grande valley. Bryant saw a great opportunity for a similar festival in eastern North Carolina.

Coastal wildlife refuges are rich in natural resources, drawing tourists even in the off-season, Bryant says. Pea Island, in particular, is a birder's paradise. Bryant saw a birding festival as a way to emphasize activities people enjoy at refuges — hunting, fishing, wildlife-spotting and photography — while also injecting money into the local economy.

"This is a chance to bring together community folks and to provide tourism that is compatible with wildlife," he says. "It sends a good message about the resources we manage. It's a win-win situation."

Many species of birds overwinter along the Outer Banks, in the sounds and pocosins, and on Lake Mattamuskeet, making a November festival a logical choice. The partners sponsoring Wings Over Water — including the U.S. Fish and Wildlife Service, the National Park Service, the Outer Banks Chamber of Commerce, the Coastal Wildlife Refuge Society and the Dare County Tourist Bureau — are eager to

bring people to the area at a time when tourism traditionally tapers off for the year. And birders seem happy to trade crowds and sun for quiet, deserted beaches, cold air and the chance to glimpse a rare creature.

Attendees come from as far away as Canada, California, Texas and Florida in search of their feathered friends. "Distance is no object," Bryant says. So local businesses and ecotourism vendors benefit from an unseasonable influx of out-of-state money. Tourists see what a beautiful place North Carolina's coast can be, even in late fall.

For the second annual festival, North Carolina Sea Grant has teamed up with the sponsors of Wings Over Water to find out just how much money the birders bring to area businesses. Thigpen, a sociologist, has designed a survey for the participants to fill out, providing valuable information about their spending patterns, interests, and impact on the local economy. The resulting information will be used to market and plan later events.

For now, Wings Over Water works hard to provide something for everyone. The schedule includes a guided tour through a salt marsh, a hike through Buxton Woods Coastal Reserve and a chance to howl at red wolves, in addition

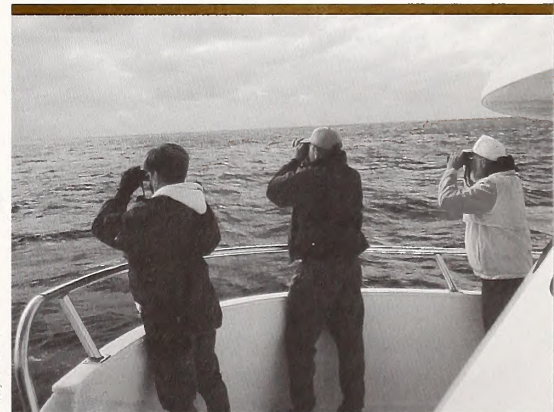
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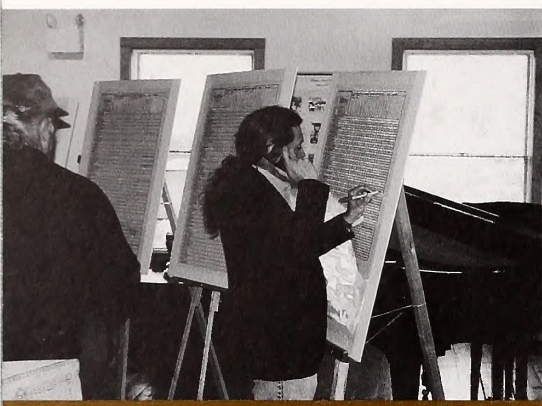
Black skimmers



Brown pelicans



Searching for pelagic birds



Keith Watson updates the bird list.

to innumerable bird-watching opportunities. Nature-lovers of all kinds can inspect the scenery from cars and buses, pontoon boats, the Hatteras-Ocracoke ferry and canoes, as well as on foot.

My paddling adventure in the Alligator River National Wildlife Refuge is one of the “general natural history trips,” and it’s my first time in a kayak. As we leave the open water and the last colorful leaves behind, I’m still searching for birds.

Though there are wood-duck nesting boxes in the trees along the shore, they are empty — our guide says the ducks actually prefer to nest in natural cavities in the tree trunks. A few members of my group spy a woodpecker through their binoculars, but I can’t see it. Finally, as I blunder down a root-choked ditch, chickadees flit in the branches overhead.

My hands are numb with cold and my jeans are stiff with water by the time I clamber from the kayak at journey’s end. Seated in my unfamiliar craft, I’ve sailed beneath towering bald cypress trees and wended my way through a maze of marsh-grass channels. Still, I’m only too ready to climb back into my car for the long drive to Kitty Hawk, where I’m staying with friends.

I’m happy to be able to throw my wet clothes in a dryer and to warm my cold bones with a home-cooked meal. But most of the festival’s 250 other participants are staying at local hotels, eating at area restaurants and buying gifts at nearby shops.

Thigpen’s survey results will show that more than 90 percent of these participants are from outside the coastal



A white ibis stalks its lunch.

region, and that they contribute more than \$90,000 to the local economy. Most of their spending is for food and lodging, but birders also drop significant sums on registration fees and birding equipment.

Fortunately for Wings Over Water, coastal North Carolina meets many of the criteria birders seek in their field trips, according to the survey results. Their number-one priority is seeing a wide variety of birds, but other high-ranking items include clean air, crime-free communities and scenic places to view wildlife.

MY HOSTS

have a clock that chimes every hour with the song of a different bird. By 6 a.m. Saturday, when the house wren warbles its tune, I’m already on the road to Lake Mattamuskeet for my next field trip.

The sun rises as I drive, and my breath smokes in the unheated car. Heavy frost bristles on the roadside, where crisp white-edged grass slopes down to meet black canals. Fog rises from the water. By 8 a.m., when the tour starts, Lake Mattamuskeet glints like metal in the sun.

“We winter about 18 species of waterfowl on the lake and adjacent freshwater marshes,” says John Stanton, wildlife biologist at Mattamuskeet National Wildlife Refuge. Altogether, the lake is a temporary home for 150,000 waterfowl.

“We have about 30,000 tundra swans and 10-15,000 geese,” Stanton says. In winter, “waterfowl, bald eagles and hawks are really what show themselves in a big way.”



A black bear munches wheat.

And this trip does not disappoint. From the lakeshore, I can see hundreds of snow-white swans. Birders spot a great horned owl, a rare Eurasian wigeon and a few Ross’s geese. “That’s a smaller version of the snow goose,” says Stanton.

Surprises include a blue-headed vireo, hermit thrush, and pine and palm warblers — small songbirds that “should have been long gone to Central and South America,” Stanton says. By far the biggest surprise is a black bear.

The tour leaps from an observation deck overlooking the marsh to the refuge’s headquarters beside historic Mattamuskeet Lodge. In the tall reeds beside the lodge, invisible songbirds make beautiful music. When I ask Stanton what is singing, he says they are marsh wrens: “They sing a really nice song but you hardly ever see them.”

I chase a belted kingfisher along one of the lake’s drainage ditches — its wings flash blue as it stays one step ahead of me, chattering. At Lake Landing, where birders walk the dikes at the east end of the lake, I spot a huge, crested gray bird on a snag over the water, its head hunched to its breast. “A black-crowned night heron,” Stanton says. I’m beginning to enjoy this feathery scavenger hunt.

I dawdle after the tour is over, and join a small group exploring the lodge, which was originally a pumping station to drain the lake and

expose fertile farmland. New Holland, the town that once flourished on the dry lake bed, is now gone — Mattamuskeet Lodge is all that remains. From its observation tower, once the smokestack for the

pumping station, I can see huge bass swimming in the canal far below.

As I drive back along the refuge's entrance road, I stop to snap pictures of long-legged wading birds stalking through

the marsh. My camera's zoom lens is no match for a good pair of binoculars, but I catch clear glimpses of ducks, turtles sunning on a log, some long-necked white birds like cranes or egrets, and a mysterious dark bird with a sharp bill.

Back at the Wings Over Water headquarters at Roanoke Island Festival Park, birders check a series of boards to see which birds have been spotted. Keith Watson, natural resource management specialist for the National Park Service's Cape Hatteras Group, keeps the master list up-to-date through cellular phone contact with group leaders.

A father and son from Oak Hill, Va., say they want to see the Eurasian wigeon, clay-colored sparrow and black-backed gull.

"What's an oldsquaw?" I ask, intrigued by the picturesque name. "It's a duck," says the father.

But some of the birds listed are more unusual than their names suggest. "We've only seen the rough-legged hawk on a few occasions," says Watson. "Maybe once a year or so. When they're here, you certainly get a lot of people going to look at them." The rufous hummingbird, which birders have also spotted this weekend, is a western species that doesn't breed in the east. "But the hummingbirds winter each year in Buxton," Watson says.

I ask him about my mystery bird in the Mattamuskeet marshes, and he invites me to look it up in one of the many bird encyclopedias offered for sale. Nothing looks quite right. Finally I settle on a brown wading bird with white flecks on its neck and an unsteady, bobbing gait.

"A limpkin?" Watson, a soft-spoken man, is unusually excited. "You'd better be absolutely positive about that."

I experience a moment of mingled euphoria and panic as he tells me that a limpkin sighting will send people stampeding to their cars. Apparently birders will drive for hours at the chance of glimpsing a



American avocets take flight.

C o n t i n u e d



A snowy egret watches white ibis feeding at North Pond on Pea Island.

rare bird, and my dubious limpkin is much more likely in South America or western Florida than in the marshes of Lake Mattamuskeet.

Of course, I can't be sure of what I've seen. After further questioning, Watson convinces me I've seen a juvenile great blue heron.

Still, for one brief moment I've tasted the thrill of bird-watching: the search for something wild and fleeting, the satisfaction in discovering something new. With

the bird book open in my hands, I know what a limpkin sounds like, what it eats and how it flies. For a few seconds, I feel like a real expert.

Outside, the Wings Over Water Festival is in full swing. While booths inside the headquarters are open every day, selling T-shirts and posters, binoculars and books, the festival is a one-day celebration to bring the birders together with the local community. There are exhibits and games, a photography contest, kayaking lessons

and carnival food. Kids can make kites, get their faces painted or build their own birdfeeders.

Gwen White, Wings Over Water's executive director, is especially proud of the festival and of the way Wings Over Water has grown. "I'm proud of the community for the way it's pulled around and supported the event," she says. In 1999, she promises, the Saturday gathering will be "even more of a family festival — we'll have music and lots of environmental

activities for children. We're working with Scouting so that Scouts will be able to fulfill some badge requirements."

Overall, White says, the festival's organizers are working hard to make Wings Over Water more inclusive, an event that supports birding as well as other naturalist activities. "Wings Over Water has always been called 'A Celebration of Wildlife and Wildlands in Eastern North Carolina,'" White says. "We're reaching out to tap into all kinds of environmental activities."

ON MY LAST DAY I get to sleep in until the bird clock chirps 7: a robin, one of the few birds I knew before coming to Wings Over Water.

My final field trip is a tramp through Nags Head Woods, a wildlife preserve owned by The Nature Conservancy. I'm looking forward to exploring the "globally rare maritime forest, towering dunes and dark swamps" promised in the schedule. And my last trip proves to be a perfect close to a wonderful weekend.

Jeff DeBlieu, whose wife, Jan,

wrote *Hatteras Journal* and *Wind*, is the Nags Head Woods preserve director and our hike leader. He's also a talented storyteller who makes the natural history of the preserve come alive.

For three hours, we follow winding trails uphill and down, marveling at the beauty of the woods and wetlands. Oaks, hickories and beeches push from the sandy soil, tangled with poison ivy and trumpet vine. Swamps lie between ancient sand ridges, home to the stumps of long-dead trees.

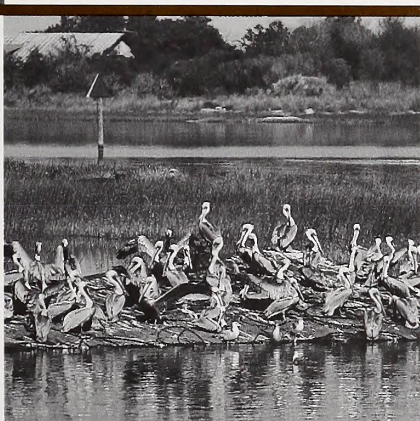
We pay respects to the preserve's former residents, who lie in a hollow beneath crumbling gravestones and bleached white conch shells. Beneath the roots of the preserve's oldest tree, a 500-year-old live oak, I find the skulls of nutria, with their orange, beaver-like teeth. And we search without success for the pileated woodpecker we can hear calling in the trees.

The pileated is the largest woodpecker in North America. "In Florida, they call it the 'Oh-my-God bird,'" says Robin Wallace, an avid birder and fish biologist. Huge size notwithstanding, we never spot the woodpecker — though we do see wood ducks and phoebes.

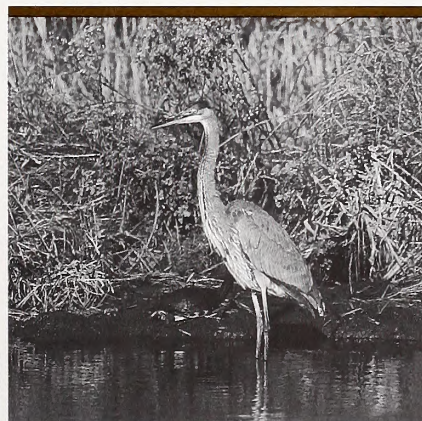
In a stunning conclusion to our tour, DeBlieu guides us up the steep slope of Run Hill, a towering sand dune that has

been moving slowly to the southwest for more than a century. It swallows the live trees in its path and leaves behind only dead snags. From the top, we can look out over estuarine marshes and Roanoke Sound to the dark shoreline of Manteo. I leave Nags Head Woods with a silent promise to return. As I climb the span of the long bridge from Manteo to the mainland, three pelicans fly low over the summit. It's a kind of benediction, and a fitting end to a magical three days. For a moment, suspended between the sound and the sky, I feel as free as they seem. ▣

Wings Over Water 1999 is Nov. 5-7. World-renowned ornithologist Jerome Jackson will be the keynote speaker. Saturday's festival will be held at Manteo Middle School. Registration is \$45; \$35 before Oct. 1. Field trips range from \$10 to \$75; workshops are \$10 and nightly programs are free. Participating educators may receive credit toward North Carolina's environmental education certification. For a schedule of events and registration form, contact the Alligator River National Wildlife Refuge at 252/473-1131 ext. 19, or check the Web at www.northeast-nc.com/wings.



Flock of pelicans



Great blue heron and yellow-bellied sliders



Birding on Run Hill



SURF'S UP AT CAPE HATTERAS:

Big Waves Make Hot Surfing Spot

By Ann Green • Photos by Michael Halminski

As veteran surfer Bob Sykes surveys the pounding waves in the Atlantic Ocean at Avon, he compares the surf to a washing machine.

"It's disorganized and has a lot of current," says Sykes. "It's more work than fun. The ideal waves are head-high and glassy, with the wind blowing over land."

Despite the choppy conditions, Sykes and other die-hard surfers are competing in the Outer Banks/Eastern Surfing Association (ESA) contest. About 110 surfers from age 6 to 55 participate in the all-day competition.

As the horn blows, Sykes and other surfers paddle out on their long boards to where the waves break. Dressed in wetsuits and colorful shirts, they disappear in the brutal surf until they find a wave to ride.

When the surfers find a good wave, they stay up on their boards for only a few seconds before disappearing again into the soapy, brutal surf. The contestants look like break-dancers on the ocean as they leap on and off their boards.

When surfing conditions are good, surfers from all over the country bring their boards to the beaches along the Outer Banks, which have developed a reputation for some of the best waves on the East Coast.

What makes the Outer Banks a good surfing spot?

"If you want big surf, you go to Cape Hatteras on the Outer Banks," says Stan Riggs, professor of marine geology at East Carolina University (ECU) and a former North Carolina Sea Grant researcher. "The continental shelf at the Cape is very steep and narrow, allowing the full brunt of the Atlantic Ocean's waves to reach the shoreline.

"Northward into Virginia and New Jersey and southward into South Carolina and Georgia, the continental shelf becomes increasingly wider and shallower, causing the ocean waves to expend their energy dragging across the shelf rather than on the beach."

Other good surfing spots include Avon,

Rodanthe and Oregon Inlet to the north of Cape Hatteras and Frisco, Cape Lookout National Seashore and Wrightsville Beach to the south.

Each Sunday, Bill Hume, co-director of the ESA's Outer Banks District, joins fellow surfers on the northern side of Oregon Inlet. "There are a lot of sandbars here and consistent surf," he says.

Because of the Outer Banks' wave-dominated coastline, some avid surfers have relocated to the area.



Contestants run to start their heat.

"Surfing is better here," says Barbara Corey, a veteran surfer. "That's why I moved here from New Jersey. I had been coming to the Outer Banks since I was a teen-ager."

As surfing has grown in popularity, the ESA's Outer Banks membership has swelled from 185 in 1995 to more than 400 this year. It has also become more family-oriented.

"When I started in the association, parents used to drop their kids off at the beach and leave them for the day," says Julie Hume, who is co-director along with her husband. "Now the parents stay."

Families arrive at the competition with their children, dogs, coolers and beach chairs. Many of them make it a daylong activity.

The Barnes family has three generations of surfers. Betty Barnes, a 70-year-old artist, rides the waves, as do her two sons, John and Rex Barnes, and Rex's two daughters.

"I started surfing when I was 35," says Betty Barnes. "My kids were teens, and I had to watch them on the waves."

She taught Rex how to surf on a long plank board.

"I knew on the first day, I would do it the rest of my life," says Rex. "It was wonderful — the thrill of riding the waves. You have to take a wave and master it. You have to make it work for you."

Since paddling on her first board at Virginia Beach, Betty Barnes has seen many changes in surfing. "When I first started, we didn't think of it as a sport," she says. "Now it is an organized sport. The equipment has also improved. In the early days, we had to make our own boards."

Now surfers can buy different styles of boards, including long boards and short boards used for maneuvers.

As the sport has grown, participation among young girls has also increased. Recently, the

ESA's Outer Banks District started a Wahines Club for female surfers of all ages.

"More girls are into the sport because they are health conscious," says Rex Barnes. "If you surf a lot, every muscle stays trim. It is a beautiful sport."

The increase in older surfers has given these enthusiasts more political and economic clout.

"As baby boomers get into their 50s, you see more older people surfing," says Mike Orbach, a long-time surfer and director of Duke University Marine Lab. "It has also become part of the political economy. On the North Carolina beaches, you see three times more surf shops as a decade ago. Surfing has become a style of clothes and line of auxiliary products."

Continued

Surfing is an ancient beach activity that was practiced by Hawaiians before becoming commonplace in California in the 1930s. However, it didn't become a popular leisure activity in North Carolina until the 1960s, when the Southern California subculture spread to the state through surf movies, clothes and music.

Early on, surfers developed a reputation as beach bums with irregular work habits. In recent years, the image of the surfer has changed.

"Surfers are misinterpreted because they have a laid-back lifestyle," says Missy McMillan, former chair of the Surfrider Foundation's Outer Banks Chapter. "There are lawyers, judges and cab drivers who surf."

Rex Barnes, a contractor, exemplifies the casual lifestyle of a surfer. He lives in a cedar house built on stilts. His living room is decorated with surfboards, surfing photos and bongo drums. He trots around the globe to surf — from Hawaii to Costa Rica.

"I love the sport because it doesn't cost anything," he says. "You get as many waves as you want for free."

Surfers also are good Samaritans.

"I have seen surfers rescue people who are caught in the rip tides near the Cape Hatteras lighthouse," says Ray Gray, a surfer and principal of Cape Hatteras Elementary School. "A couple of years ago, another guy and I saved two girls who were drowning near the lighthouse."

Despite the increased interest in surfing on the East Coast, it is still more accepted on the West Coast, says Orbach. "In North Carolina, the dominant water-related activity is fishing."

Surfers also have to follow more regulations on the East Coast than on the West Coast.

Since piers are publicly owned on the

West Coast, surfers aren't restricted from going under piers, says North Carolina Sea Grant researcher Jeff Johnson, an ECU sociologist who has traveled the world to surf. "Piers make good surfing spots because of sandbars and better waves," he says. "In contrast, most piers on the East Coast are privately owned."

In North Carolina, the legislature has

given municipalities the right to regulate surfing as long as the rules don't inhibit a citizen's constitutional rights, says Walter Clark, North Carolina Sea Grant coastal law and policy specialist.

"The state has jurisdiction and ownership of ocean waters and land under the ocean from the mean high tide to three miles out," says Clark. "However, the state recognizes that local governments have an interest in certain activities that occur in state waters which are adjacent to their jurisdiction."

Most coastal municipalities have adopted surfing regulations. At Atlantic Beach, surfers have to stay 200 feet away from the fishing piers and can't surf in heavily populated areas. In Nags Head and Kitty Hawk, surfing is prohibited within 300 yards of a fishing pier. Wrightsville Beach requires surfers to stay 500 feet away from commercial fishing piers and from the jetty at Masonboro Inlet.

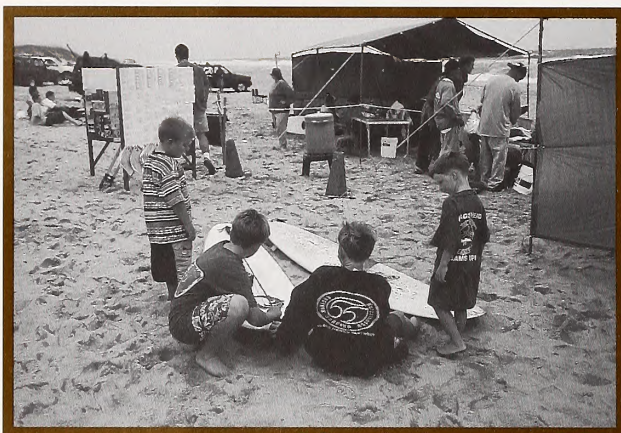
Most townships also require surfers to have leashes on their boards. "If you have a leash on your board, your board won't get away from you when you fall off and possibly hit someone," says Julie Hume.

Except for the regulations around fishing piers, most surfers have free access to North Carolina's waters.

"Dare County does not have any rules banning surfing at certain times," says Julie Hume. "Some places on the East Coast don't allow surfing at certain times

of day and only in designated areas. We are fortunate we can surf at any time of day or any place on the Outer Banks."

Because of surfers' affinity for oceans and beaches, some have become advocates for coastal issues. One of the most active grassroots organizations is Surfrider Foundation, which has 25,000 members, 42 chapters in the United States —



Young "gremmies" check out some new shapes.



Surfers pass heat signal flags and contestant jersey racks.

including one on the Outer Banks and one in Wilmington — and four international affiliates.

"I am a water enthusiast and believe in the foundation's mission statement: 'clean water, clean beach and access to beach,'" says McMillan. "We do this through conservation activism, research and education."

At Rodanthe, members worked with public officials to increase public parking near a private pier, thus offering greater beach access.

"The only access for the public is at the private pier," says McMillan. "The pier owner wanted his pier used for fishing and not surfing. Our chapter tried to smooth matters over with the pier management and worked with Dare County to donate land and build a parking lot." The group also received a state grant.

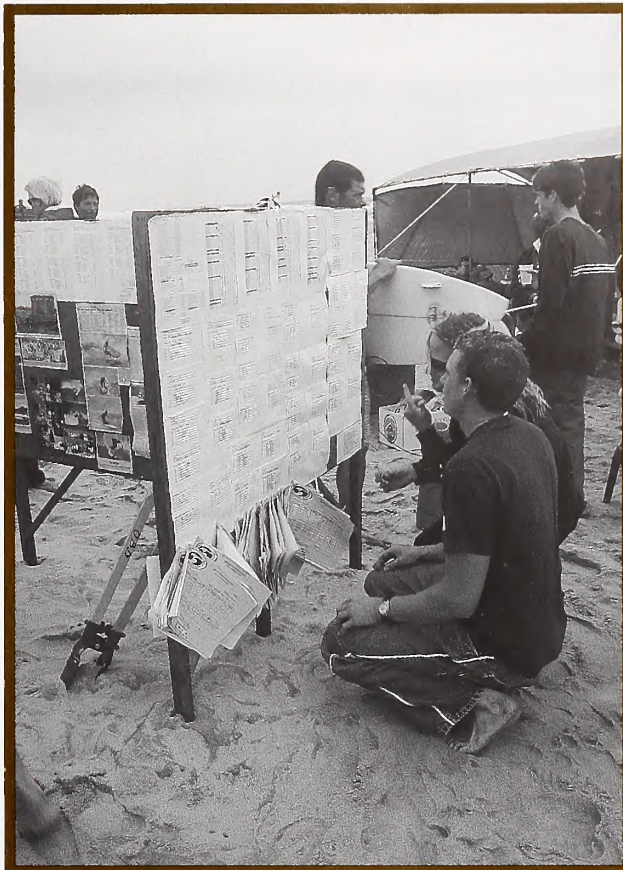
The organization also supported the relocation of the Cape Hatteras lighthouse. "Nationally, Surfrider is against hardened structures like jetties and sea walls," says Joan Van Newenhizen, co-chair of the group. "We believe nature should take its course."

Occasionally, the ESA Outer Banks District advocates for surfers' rights. When the Currituck County Board of Commissioners wanted to ban surfers in the water during red-flag days, the ESA convinced them to allow surfing during turbulent weather.

"Experienced surfers know when not to go into the water," says Julie Hume.

The Surfrider Foundation also is environmentally active, encouraging good stewardship of coastal resources.

As keepers of the coast, the group educates young people about preserving the beach. Each year, they sponsor a "Respect the Beach" poster contest for middle and high school students. Last year, they



Contestants check the scoreboard.



Two surfers anticipate their 3A men's heat.

sponsored a half-day "Respect the Beach" camp for youngsters between ages 5 and 9. The group also gives an Outer Banks Surfrider Scholarship to a high school student.

The group conducts research when needed. After a Halloween storm in 1992 flooded the bypass in Kitty Hawk, the town proposed an outfall pipe for storm runoff.

The Surfrider Foundation countered with an alternative plan.

"We had concern about the petroleum runoff," says McMillan. "One alternative that we proposed was putting a gate valve on the pipe. When we have a big storm, the valve is opened."

The Outer Banks Surfrider Foundation also initiated the first Adopt-A-Beach program in 1993 in Dare County, covering over 20 miles of public beach. The program is modeled after the Adopt-A-Highway Program. "It has been a very successful endeavor and involves various segments of the community working together to keep our beaches clean and beautiful," says Van Newenhizen.

Each September, the organization helps coordinate Dare County's Big Sweep, part of a statewide waterways cleanup. For the last three years, the chapter has provided trash bags across the state for Big Sweep.

Other surfers continue the cleanup year-round. Once a month, ESA members clean up a beach on Oregon Street in Kill Devil Hills.

The Outer Banks Surfrider chapter was formed in 1991. "Our main impetus was stopping offshore oil drilling by Mobil Oil," says McMillan.

Since then, the chapter has been involved in a number of coastal issues.

After a campaign by the group to raise awareness of poor water quality, Dare County began a water-testing program.

"Over the last 50 years, the surfing culture has evolved from sport to business to environmental action," says Orbach.

"The Hawaiians use the concept of a 'waterman' to mean someone who surfs, sails, fishes, and is generally aware and a knowledgeable user of the ocean and its resources. That is what many of today's surfers strive for." □

"DR. DAN"

By Renée Wolcott Shannon • Photos by Scott D. Taylor

The estuary is like a giant organism," says Dan Rittschof. "You find crabs in its armpit. It smells different in different places."

Colleagues and students at Duke University Marine Laboratory know to expect such offbeat and provocative comments from Rittschof, a zoology professor who has taught at the lab since 1982. Fellow researchers call him "a creative scientist" and "a guy with ideas going off like popcorn." Students call him "Dr. Dan," praise his teaching and leave friendly messages taped to his office door.

In person, Rittschof's energy is palpable. He is a compact, wiry man with permanently tanned skin and an unruly beard. He walks fast, laughs often, shows off his research projects with enthusiasm and a flair for drama. "I can make crabs puke and teach you how to catch flounder with your bare hands," he boasts, and he's not kidding.

His research focuses on the biochemistry and physiology of animal behavior. "I'm curious about what makes animals do things," he says. In the past, he's asked how hermit crabs locate new shells, why fish prefer certain foods, and how barnacle larvae know where to settle — and he's found answers in bio-active molecules and chemical sensory systems. Given the right mix of molecules, he can make a fish eat gravel.

Several years ago, North Carolina Sea Grant funded a project in which Rittschof collaborated with fellow Duke scientist Celia Bonaventura to develop a nutritious, palatable food for larval fish. The lack of such a food has traditionally posed a problem for aquaculturists.

Even adult fish do not select and "taste" food the way we do, with our tongues. Instead, fish have epibranchial

organs that sense the chemical makeup of food. "A fish sucks something into its mouth and stuffs it into the epibranchial organ," says Rittschof. "If it tastes good, the fish swallows it. If it doesn't, it spits it out." Preferred foods share certain chemical traits — complex combinations of molecules that fish find "tasty."

Fish food used in aquaculture is often based on cereal, which lacks the flavor molecules that fish prefer. "Cereal doesn't taste like a hamburger," Rittschof says. "Vegetarians know that." The researchers' first hurdle was to find a flavoring that adult fish preferred — and they found that soup stock was a favorite with a wide range of fish, including salmon, trout, flounder and bass.

The second hurdle was to convince larval fish to eat a processed food. Fish are visual predators who expect their food to move, and baby fish usually eat microscopic creatures like rotifers or brine shrimp. Even adult fish must be trained to accept fish pellets as food, and no one was sure that baby fish could learn to recognize motionless fish flakes as something edible.

In Rittschof and Bonaventura's experiment, they fed baby flounder through pipettes — first with brine shrimp and later with manufactured liposomes full of the nutrients they needed. The lipids in the liposomes' walls prevented the food from dissolving in water. And the researchers found that the larval fish would eat the processed food.

"Baby flounder are very smart," Rittschof says. "They'll sit at the end of the pipette and wait for food." He remembers this more than anything else about the experiment, though his findings led to the large-scale production of flavored fish food and the development of chemically attractive fishing lures.

His appreciation for the miniscule flounder, and for the way they adapt to their environment, reflects his boundless curiosity about animals, their habitats and the surprises they offer. This curiosity makes him a perfect match for Duke Marine Lab, which is situated in Beaufort amid estuaries and barrier islands and which celebrates the importance of a sense of place.

"Dan embodies one of the primary principles of the lab, which is that it is a field station," says Mike Orbach, director of the marine lab. "People can get out and get dirty, literally, and see nature in all its cycles." Orbach says Rittschof is one of the most active faculty members, as far as getting students involved with field research. "He's a denizen of Carteret County waters — he knows where everything is all the time."

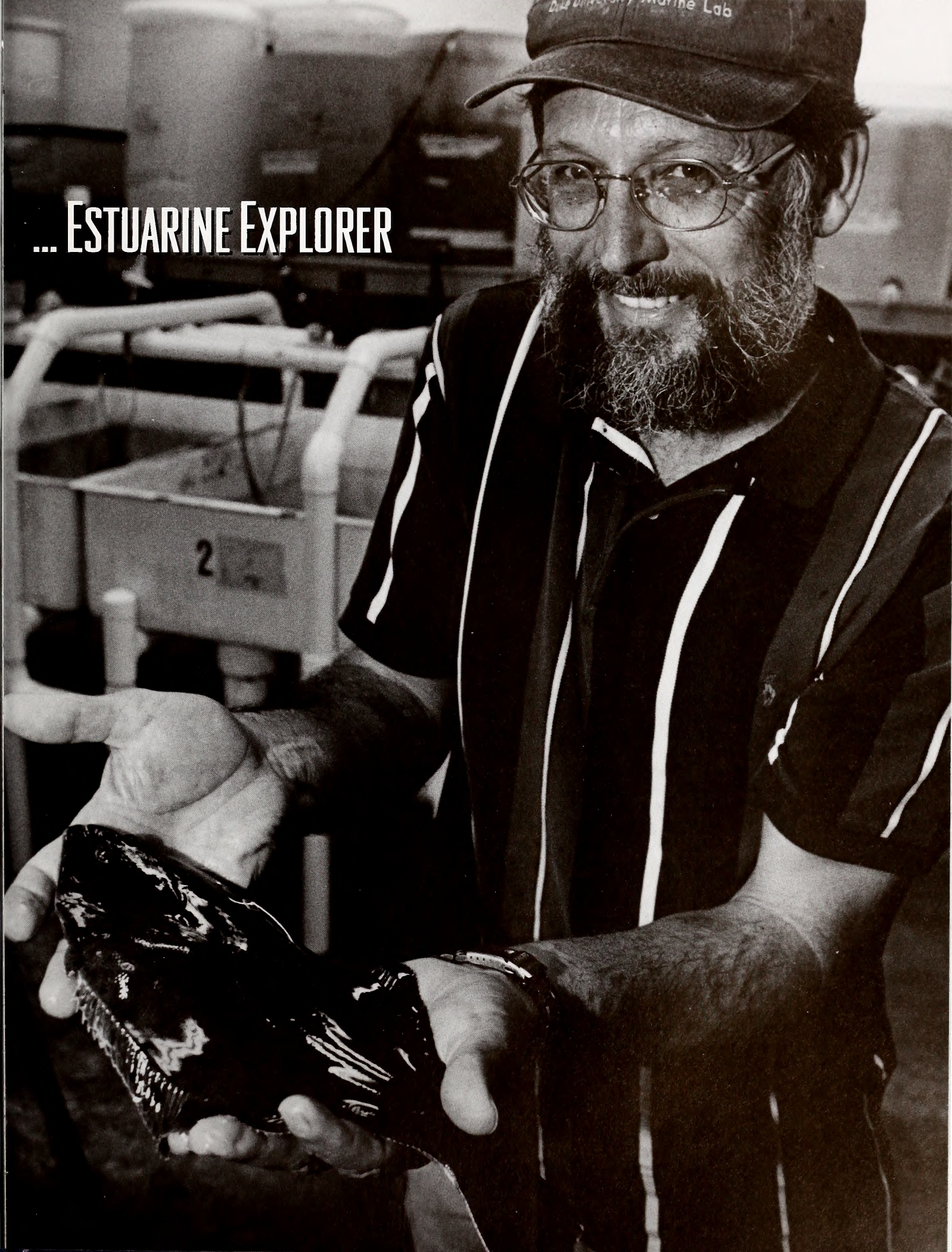
One reason for this knowledge is that Rittschof spends day and night at the marine lab, exposing students to the natural world that surrounds Pivers Island. He leads countless field trips. He keeps his laboratory and office open for student projects, and students have used his printer to spool off reams of research papers.

Rittschof serves as mentor and guide for many undergraduates' independent study projects. "I don't recognize disciplinary boundaries," he says. "I'll follow a problem across any line. ... I've worked on almost all the common animals around here."

Continued

AT RIGHT: DUKE RESEARCHER DAN RITTSCHOF PROUDLY DISPLAYS ONE OF THE TAGGED FLOUNDER HE TRACKS IN THE ESTUARY.

... ESTUARINE EXPLORER





RIITTSCHOF IS FAMOUS FOR LEADING FIELD TRIPS INTO THE ESTUARIES AND MARSHES NEAR DUKE MARINE LAB.

His students' research focuses on everything from fish to invertebrates. Previous protégés have studied hormonal control in fiddler crabs and the aerosol filtering apparatus in mole crabs. Rittschof will follow his curiosity, and his students, anywhere. "He lives what he teaches," says Orbach.

And what Rittschof teaches is the organic complexity of nature, as revealed in a set of chemical systems that have evolved to shape animal behavior. When he says an estuary is like an organism, he is serious: the estuarine habitat around Pivers Island is his biggest, most complicated research animal yet.

From his third-floor office, Rittschof can look across a narrow channel and see one particular estuary — "his" estuary — a square kilometer of sand, mudflats and shallow water on Carrot Island. For the last 17 years, he has been getting intimately acquainted with his estuary, fascinated by the vital interconnectedness of its parts.

Terns and killdeer sweep across the embayment, island horses wade through it, flounder skim along its bottom. Fresh water seeps in from a spring on the eastern shore. On very high tides, ocean water spills across the dunes to flood the bay with salt. Every inch of the estuary offers new research possibilities.

"All the male blue crabs sit in pits in one tiny part," Rittschof says. "Are they there because of physics or does it smell good to them?" Though the bottom of the estuary is crowded with thousands of tiny snails, some patches are completely bare. Why?

For Rittschof and his students, the estuary is an open-air laboratory that provokes an endless stream of questions. He leads nighttime canoe trips there, catches its flounder by hand, tracks its snails and sediments, measures its salinity. With Jonathan Kool, a graduate student, he is mapping the estuary in 10-meter increments and digitizing all its flora and

fauna, its sediments and waters, using the Geographic Information System (GIS).

"I want to know how everything works in this soft-bottom environment," he says. "I'm doing this because I'm curious about it and I like it. I want to know how the world is put together." Rittschof hopes to make a long-term database of all the activity in the estuary to document and publicize the animals' interactions with each other and with the environment.

The estuary project is merely the latest and most ambitious in a line of research projects that stretch back to Rittschof's childhood. He has made a career of asking "why." As a boy, he spent summers in northern Michigan with his family. "When I wasn't picking cherries for money, I was catching things," he says. "Usually I was fishing. I was interested in anything that moved." He was especially intrigued by the creatures that crept and slithered and flew at night. Nightcrawlers were a favorite catch.



RITTSCHOF EXAMINES AN ANTI-FOULING EXPERIMENT WITH A STUDENT.

"And then I caught things for my dissertation," he says. "Frogs." Though his favorite high-school subject was chemistry, he found himself drawn to ecology at the University of Michigan. His college studies saw the beginning of his exploration of the interrelationships between animals and their environment, and for his doctoral dissertation, he studied the chemical ecology of hibernating freshwater frogs.

Then came a turning point. Just after receiving his Ph.D. in 1975, Rittschof saw the ocean for the first time, on a trip to the Florida Keys. A child of the Southwest and Great Lakes regions — he was born in Arizona in 1946 — Rittschof had never seen the marine environment face-to-face. And now he was sure of one thing: he wanted to study chemical ecology in marine systems.

After post-doctoral work in biochemistry at the University of California at Riverside, Rittschof got his first chance to tackle a real-life problem. One of his

Michigan professors had questioned the mechanisms by which hermit crabs in the Gulf of Mexico locate new snail shells to live in. Hermit crabs have no hard covering of their own, and as they grow, must constantly find larger snail shells to inhabit. How do they find empty shells of the correct size?

Rittschof believed that the answer lay in the crabs' ability to detect certain chemicals that were released when the snails died. "Chemical perception is a sense that you don't think about much," he says. "It's much more than the sense of taste or the sense of smell. There are additional capabilities, like pheromone reception and the perception of environmental odors, that are poorly understood."

To support his theory, Rittschof had to locate the specific molecule that the crabs responded to, and figure out how it was produced. Working on vacation and during the afternoons at a Florida conference, he researched and wrote two papers

that described his discovery: when one snail eats another, an enzyme in its saliva reacts with the other snail's muscle tissue to produce the molecule that hermit crabs respond to.

And different snails — with different shells — produce different mixtures of peptides within the molecule. Hermit crabs only respond to molecules signaling the right-sized shells.

With two published papers under his belt, Rittschof was on his way. In 1980, the University of Delaware hired him to figure out what kinds of molecules tell oyster drills that living oysters are nearby. Oyster drills are predatory gastropods that drill through the shells of living oysters and eat them, costing fishers and the seafood industry millions of dollars.

His Sea Grant-funded research with the oyster drills received the prestigious Dean's Prize from the College of Marine Studies, used two million larval oyster drills and netted enough material to fill 16

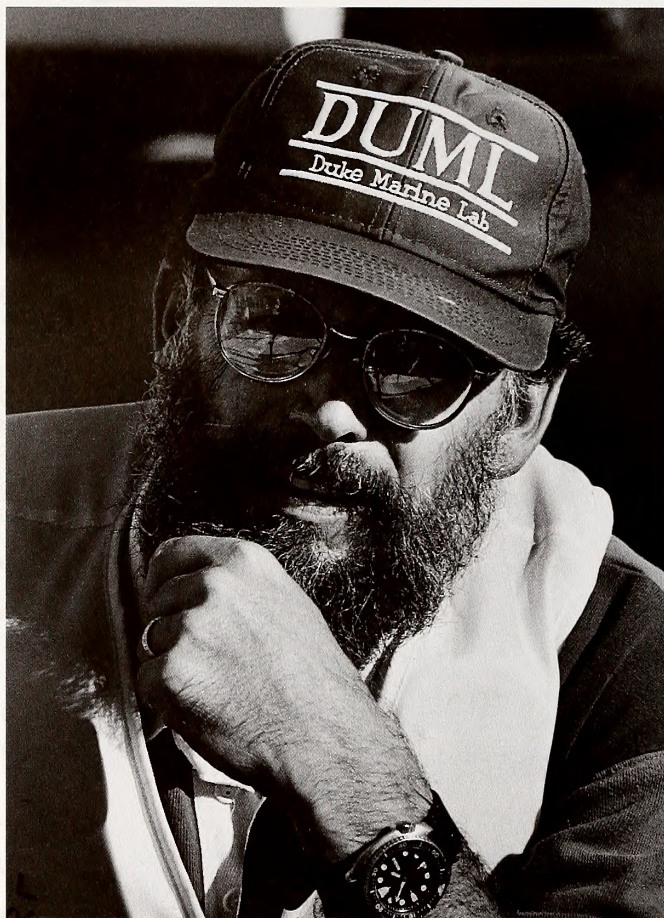
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research papers. Rittschof found the molecule that oyster drills respond to in the chemical “body odor” that oysters and barnacles produce. Amazingly, it is the same kind of molecule that tells hermit crabs a new shell is available.

“Evolutionarily, these are really old molecules and really old chemical-reception systems,” says Rittschof. His research points to the ancient development of systems of chemical communication — perhaps so ancient that it predates the evolution of multicellular organisms. “A molecule in human blood tells all the white blood cells to creep to the site of a wound. ... The same kind of molecule tells hermit crabs that a shell is available.” And it tells crabs to release their larvae, barnacle and oyster larvae to settle out of the water column, and oyster drills that they have found their lunch.

Because the molecules and the chemical communication systems that perceive them are so old, the systems are the same from animal to animal. “You can’t modify the transduction system, but you can shape it to different ends,” says Rittschof. Animals read different pieces of the same molecule and perform different behaviors as a result, but the medium for receiving and processing the chemical message — the hard-wired reception system — is always the same.

Rittschof’s work with the chemistry of animal behavior brought him to Duke in 1982, where he was hired to develop a non-toxic anti-fouling compound based on extracts from soft corals. Existing anti-fouling paints use copper to prevent barnacle growth, but copper is a bio-active



“DR. DAN” PONDERES THE COMPLEXITY OF NATURE.

element that can be toxic in the marine environment.

Rittschof eventually received seven patents based on his anti-foulant work, but mass production of the products he developed is on hold. “Registering the compounds would take about 10 years and cost about \$11 million,” he explains.

So now he is once again concentrating on chemical sensory systems, isolating the bio-active enzymes in fish mucus that tell blue crab larvae and other small prey that a predator is near. With fellow researchers Richard Forward Jr. of Duke and Richard Tankersley of the Florida Institute of Technology, he also has received funds from the National Science Foundation to study how the dynamics and “smell” of estuaries influence the blue crab larvae who settle there.

In unlocking the secrets of blue crab settlement and fish “body odor,” as well as developing anti-fouling paint and better fish lures, Rittschof bridges a long-standing chasm in modern science. “There are two kinds of science,” he says. “Science that asks how things work, and science that applies knowledge in practical ways.” Rittschof does both.

His office is a testimonial to his wide-ranging interests, and to his respect for both practical and “pure” science. On a crowded bookshelf behind his chair stands one of his patent certificates. Another shelf is dedicated to fossils he has collected, including sharks’ teeth, a marlin’s bill, sand dollars and a horse’s molar. Chemical diagrams are scrawled on a blackboard beside his desk.

Walls and bulletin boards flutter with photographs and mementoes from students — a snapshot of “Dr. Dan” flanked by grinning coeds, a huge Chinese scroll that he insists reads “Don’t worry, be happy,” an inscrutable paper oval above his computer that says, simply, “Bacon.” “People bring stuff in here and leave it,” Rittschof says with a bemused smile. And he keeps it all: paintings and prints, an embroidered cat, an Italian “candy” made of glass.

Beyond the window lies his cherished estuary, with all its animals and their particular chemistries. Inside is the cluttered habitat Rittschof has created for himself, full of reminders of the work he loves.

“It’s all about teaching and curiosity,” he says. ■



Operation Pathfinder participants listen as Stan Riggs explains coastal dynamics on the Oregon Inlet jetty.

Getting to Know the Coast:

An Education for Teachers

By Ann Green • Photos by Michael Halminski

As waves crash against the rock jetty near the Herbert Bonner Bridge on Oregon Inlet, East Carolina University marine geology professor Stan Riggs describes it as the "highest-energy inlet on the East Coast."

"It's like a tiger caught in a trap," says Riggs.

Oregon Inlet opened in 1846 just north of the present location of the Bodie Lighthouse, which is now more than three miles from the inlet's waters.

Two lighthouses built on the inlet's south side were lost to erosion as the inlet migrated south at about 200 to 300 feet per year. In 1876, the Bodie Lighthouse was built on the north side.

Because of the inlet's southward migration, the Bonner Bridge, built in 1962, was in danger of being left behind by the inlet, Riggs explains. To stop the migration and save the bridge, the state built a rock jetty on the south side.

"This has temporarily trapped the

tiger," he says of the controversial jetty that faced opposition from some scientists and environmental groups.

Riggs presents the history of the inlet as a coastal processes lesson to elementary, middle- and high-school teachers in COAST/Operation Pathfinder. Loaded down with backpacks and water bottles, the teachers follow Riggs along the rock jetty bordering the inlet.

Pattie Chapman, an eighth-grade

Continued

teacher from Delaware, finds the marine geology lesson very informative. "I am interested in the natural conservation of the environment. I have watched the whole environment being raped. ... It is important to maintain an equilibrium with the environment and understand how geology works with plant life. We have a real obligation to teach our students about these processes."

Oregon Inlet

isn't the only place teachers explore during their 15-day course. During field trips and classroom activities, 27 teachers from the mid-Atlantic states, Georgia, Idaho and Missouri have learned firsthand about marine life and coastal processes along North Carolina's Outer Banks and the Virginia shore of the Chesapeake Bay.

Lundie Spence, marine education specialist for North Carolina Sea Grant, leads the course with Vicki Clark from Virginia Sea Grant, Terri Hathaway from the North Carolina Aquarium at Roanoke Island and Bill Martin, a teacher with the Forsyth County Schools. North Carolina Sea Grant and Virginia Sea Grant co-sponsor the course offered through NC State University.

*"It is important to maintain
an equilibrium with the environment
and understand how geology works
with plant life. We have a real
obligation to teach our students
about these processes."*

Pattie Chapman, Delaware

Spence says it's important for all teachers — whether they live near the sea or inland — to understand the dynamics of the coast and its living resources. "In addition, teachers need to meet researchers to understand how science works. In the



Lundie Spence explains sand types and beach composition to Operation Pathfinder participants.

next century, coastal states will be facing important decisions about their shorelines. These decisions should be made by people who understand the science and sociology of an area."

Kathryn English, a science teacher at Pamlico County High School in Bayboro, plans to use her experiences to develop hands-on activities for her students.

"I want to have my seniors develop an ocean lesson and present it to elementary students," she says.

COAST/Pathfinder began as a pilot program in Mississippi in 1993. One year later, it was implemented in six regions across the country. The program now includes Web technology and an integrated approach to education. Participants learn how to develop Web pages and find lessons on the Internet.

"In six years, the program has been offered twice in North Carolina," says Spence. "It also has rotated among Sea Grant programs in Delaware and New Jersey."

COAST is funded through the

National Ocean Partnership Program by the Office of Naval Research, in cooperation with the National Marine Educators Association, the University of Southern Mississippi, St. Norbert's College in Wisconsin and the National Sea Grant College programs.

The participants range from recent graduates to educators with more than 20 years of experience. Several of the teachers work with disadvantaged students who have little access to the coast.

"One of our objectives is to illustrate career opportunities in oceanography," says Spence. The program includes presentations on careers, deep-sea experiments and bay fisheries by researchers at the Virginia Institute of Marine Science (VIMS). "Oceanography is a field that is underrepresented by minorities and women," she adds.

One of the COAST course requirements is to develop a curriculum and lesson plans for the fall semester. The program also emphasizes the use of technology and multi-disciplinary approaches to teaching.

For example, science and literature lessons can be combined.

Beth Howard, a teacher at Dixon Elementary School in Onslow County, will use the coastal experiences in her art curriculum. While on the field trip, Howard has sketched marine life, coastal buildings and other coastal memories in her journal.

"I am going to share the journal with my students," she says. "A picture is worth a thousand words. It's cheaper and more personal than photos."

Teachers began the COAST course in Virginia, where they waded on a restored oyster reef on the Piankatank River, measured plant zones in a salt marsh at the York River State Park in Lightfoot and participated in activities at the Virginia Marine Science Museum in Virginia Beach.

"It was awesome standing in the middle of the bay and picking up oysters and crabs," says English. "The reef was more movable than I thought it would be."

The group also investigated coastal environments in North Carolina — from kayaking in choppy waters in Shallowbag Bay to an aerial tour of the barrier islands. "We had a great time kayaking," says Mike Jordan of Raleigh, a 1999 NC State graduate. "We saw thousands of jellyfish in a marsh creek."

One day the group traveled from Nags Head to Buxton to observe coastal processes, stopping at the Pea Island National Wildlife Refuge, which was established in 1938. During the winter, migratory waterfowl feed in the large ponds.

On the beach in front of the refuge, participants sampled different kinds of sand — from the dunes to the surf — and used their fingers to collect sand samples.

"You can take a piece of tape and remove sand for further study in the classroom," says Spence. "Students can compare and contrast the diversity of the sand."

The teachers got a glimpse of maritime history at the Chicamacomico Lifesaving station in Rodanthe, one of the first seven U.S. Lifesaving Service complexes used to rescue shipwreck survivors at sea. The service later became the U.S. Coast Guard. The site is now a museum packed with life-saving devices and rescue boats.

*"It was awesome standing
in the middle of the bay and
picking up oysters and crabs ...
The reef was more movable
than I thought it would be."*

Kathryn English, Bayboro, N.C.

Behind the lifesaving station, the teachers looked at houses threatened by a high erosion rate. "This reinforced the dynamics of the beach to the teachers," says Spence.

One of the highlights of the trip was watching the relocation of the Cape Hatteras lighthouse. The teachers joined the crowd of people lined against the fence to see the lighthouse move along rails, powered by hydraulics.

"It was fascinating seeing how the lighthouse move is related to earth science and geology," says Andrew Cohen, an earth science teacher at Butler High School in Matthews. "It was also interesting to see how a natural phenomenon affects society."

Spence is excited about the quality of the teachers in the program.

"I am looking forward to seeing how they apply their coastal experiences this fall in their classrooms," she says. ■

For more information on future COAST/Pathfinder programs, contact Lundie Spence by phone at 919/515-2454 or by e-mail at lundie_spence@ncsu.edu.



Operation Pathfinder with program leader Terri Hathaway and Park Ranger Doreen Ruffing at the Cape Hatteras lighthouse site.

Who Owns the Beach?

By Renée Wolcott Shannon

The beach season is drawing to a close. Kids are back in school, and fewer cars packed with towels, sunscreen and plastic toys trek to the coast every weekend. But for the past few months, vacationers have crowded North Carolina's miles of public beaches.

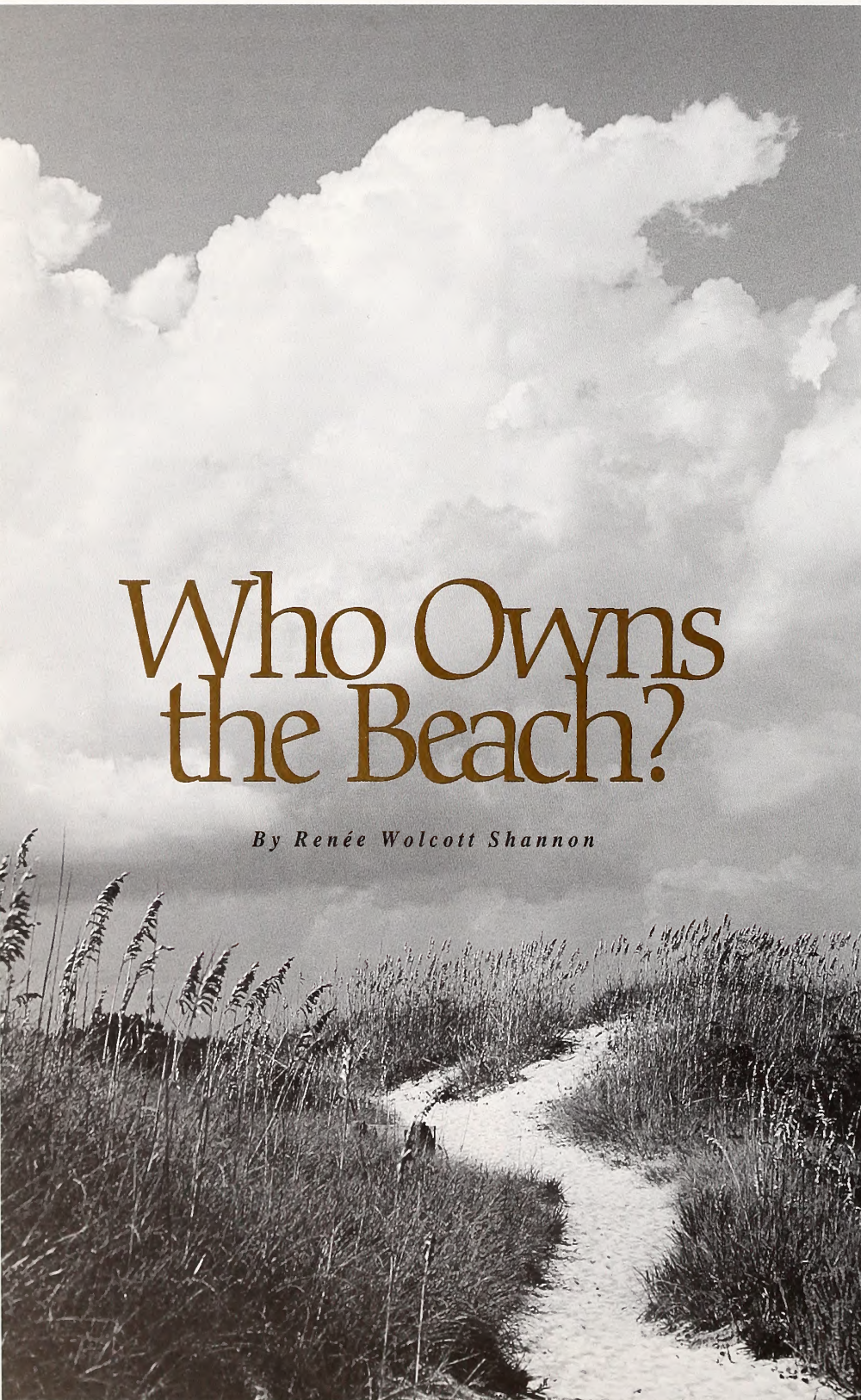
On Saturdays in July and August, the roads to the Outer Banks are clogged with traffic heading for the sandy shore. North Carolina vehicles jostle with cars from Ohio, New Jersey, Virginia and Pennsylvania. For many vacationers, this trip to the beach is a summertime ritual, whether it takes hours of driving or a quick walk across the street. The wide, sandy beaches draw surfers, sunbathers and fishers from across the state and around the country, and they are open to everyone.

Traditionally, North Carolina has welcomed visitors to its shoreline. The Coastal Area Management Act (CAMA), which regulates coastal development, also provides a beach and waterfront access grant program for local governments. With funding from CAMA, seaside towns can buy coastal property and build public parking lots and walkways over the dunes. Some communities also provide shower facilities and dressing rooms.

Such Southern hospitality has made North Carolina's coast a hot summertime destination. But can visitors take public beach access for granted? Not necessarily, says Walter Clark, coastal law and policy specialist for North Carolina Sea Grant. The rising demand for recreational shoreline space is part of the problem.

The right to cross the dunes and plant an umbrella in the sand has its roots in Roman law, which held the seashores to be publicly owned. Later, English common law took up the tradition, and the United States followed suit. Some states, like Virginia and Delaware, allow public use of the beach only below the low-tide line, functionally removing the entire beach from the public domain. Other states, like Hawaii and Oregon, have proclaimed the beach to be accessible to the public up to the first line of vegetation, usually at the edge of the dunes.

Like many other states, North Carolina holds its coastline in public trust to the high-water line, which means that the wet-sand



Scott D. Taylor

beach below the high-tide line is public property. According to property titles, the dry-sand beach landward of the high-water mark is privately owned, but beach-goers have usually marked out their territory in the dry sand without provocation.

That may change soon, Clark says. The booming population in coastal counties — particularly Dare, Carteret and New Hanover — puts increasing pressure on the same

beach resources. Until early this century, “there weren’t many people in coastal North Carolina, and there was lots of beach,” Clark says. “People were spread pretty thinly.” But on a cloudless summer day, people now crowd the sand up and down the state’s 230 miles of beaches.

And few of these people stick to the wet sand. Though the dry-sand beach may not be included in the state’s public-trust holdings, coastal visitors and residents have long used it for sunbathing, picnicking, fishing and traveling. Some beachfront property owners have objected to this in the past, putting up fences or signs at the high-tide line to keep the public off the dry-sand beach, but the state has always intervened.

“The public has been using the dry-sand beach since the first colony was established,” says Donna Moffitt, director of the N.C. Division of Coastal Management. The state’s position is that long-time public use of the dry sand constitutes an extension of public-trust rights beyond the high-water line, or an easement for public use of private property. And until now, the fences or signs have always come down.

But in June 1998, a small group of property owners in the Whalehead Club subdivision on Currituck Banks filed a lawsuit against Currituck County, the state of North Carolina and the developers of their subdivision in an effort to keep the public off their private property. They claim that the public’s use of the dry-sand beach prevents them from enjoying their property and that public parking lots and walkways are in violation of subdivision rules.

The complaints listed in the lawsuit include trash and human waste found in back yards, trespassers who use private showers under homes and strangers who request the use of a telephone or bathroom. If the state doesn’t remove public beach access to the area, the plaintiffs, who bought their land with the assumption that the beach was private, want to be paid for the public use of the dry-sand beach.

Gary Shipman, a Wilmington attorney representing the Currituck plaintiffs, sums up his clients’ lawsuit in two words: property rights. “One of the fundamental property rights which property owners in North

Carolina have is the right to exclude others from their property, and our litigation seeks to have the courts recognize that right,”

Shipman says. “If the state wants the public-trust doctrine extended, they will have to ‘pay’ for that, as it would then constitute a taking of our clients’ property without compensation, in violation of the state and federal constitutions.”

Though the homeowners also seek judgment on several other issues, including the subdivision’s drinking-water supply and paved roads, the quarrel over public beach access is stealing the most headlines.

“If the state lost the case, there would be a major negative economic impact from lost tourism,” says Moffitt. “Rental properties behind the first row of houses would be reduced in value, because the people there would no longer have access to the beach.” Vacationers could face prosecution if they trespassed on the privately owned dry-sand beach. At high tide, wading or swimming would be the only recreation available.

The state is “vigorously defending its position,” says Moffitt. “We’re arguing that North Carolina citizens have always had public-trust rights on our beaches. ... People have bought property along the coast with the knowledge that the public uses the beaches in this state.”

To make the state’s position clear, the General Assembly passed a bill on public beach access shortly after the lawsuit was filed. The bill declares the beach open for public use from the first line of vegetation seaward, due to the “frequent, uninterrupted, and unobstructed use of the full width and breadth of the ocean beaches of this State from time immemorial.”

The bill’s timing has raised some eyebrows, but its intent is clear: to provide resolution on a divisive issue. The ongoing litigation highlights the need for court interpretation of the state’s position on public beach access.

“Laws are passed all the time. Many of them are later overturned by a court decision,” Clark says. “We need clarity on something as important as the beach, which so much of our coastal tourism depends on. This is a question that has been hanging out there a long time.” □



Scott D. Taylor



Katie Muehr



Courtesy of New & Observer

In one of the first aquaculture efforts of its kind, a North Carolina Sea Grant researcher and a Cedar Island flounder farmer are fattening wild-caught fish to a more desirable market size.

The North Carolina Fishery Resource Grant project is testing a theory that pound-net fishers in the Albemarle and Pamlico sounds have pondered for years, says Sea Grant researcher Harry Daniels.

"The fishermen called me up with this idea," says Daniels, a warm-water aquaculture specialist at NC State University's Vernon James Research and Extension Center in Plymouth. "They called it flounder fattening."

The price per pound of flounder often rises when the short season ends in early winter, hence the interest in simply keeping the catch alive until its value increases. Because larger flounder draw higher prices, nurturing them to increase weight during the holding period makes sense.

Daniels, who has done extensive research on spawning and culturing flounder, started a two-year flounder-fattening trial in 1997. The grant has been extended a few months to refine and analyze growth rates and economics. The Fishery Resource Grant program is funded by the General Assembly and administered by North Carolina Sea Grant.

The grant financed the construction of a holding tank operation at the Pamlico Aquaculture Field Laboratory in Aurora. There, Daniels monitors how the fish — mostly southern flounder — react to captivity and variations in the tank environment.

"We wanted to learn what people would have to do to raise this fish," Daniels says. Wild broodstock used in spawning experiments had already revealed that flounder don't like to be alone.

"They've got to be stocked densely to get them to eat," Daniels says. No matter how few the flounder or how large the tank, "they'll pile on top of each other," he says. Daniels theorizes it's "a comfort thing," similar to how cats like to snuggle together. The tendency for togetherness also might

Fatter Flounder

Down on the Farm

By Julie Ann Powers • Photos by Scott D. Taylor





Above: Moon Park shows the clean white side of a flounder, which draws a high price in Asian markets.

At Left: This Cedar Island flounder-fattening pond is full of fish.

be magnified by the tanks' lack of a sand or silt bottom cover, which would compromise water quality and flow.

Flounder want company, but they also require plenty of tank space — contradicting fishers' speculation that flounder could be kept in shallow trays. "They've got to be able to swim around, even though they're flat," Daniels says.

Tanks also need to be shaded from the sun and kept clean. If there's anything in the environment the fish don't like, they won't eat. Sometimes they don't eat no matter what — 20 to 30 percent of flounder respond to captivity by refusing to eat. "Those fish you have to identify early on and sell them before they get too thin," Daniels says.

Some flounder refuse more economical chopped bait, insisting instead on a

traditional diet of live fingerlings. "It's hard to get them to eat chopped fish," Daniels says. "What we're trying to avoid is people having to go out and catch a bunch of juvenile fish every day."

Daniels is working with a commercial operation in Cedar Island. Moon S. Park of Coastal USA Fish Co. had been a seafood dealer in Wilmington for many years, handling flounder and other fish largely for Asian markets. He was getting his holding tank operation started when the grant was approved, and he agreed to be part of it.

From his marketing experience, Park figured that fattening small flounder could meet the demand, particularly among Asian markets, for big, plump flounder. Fat flounder are preferred for sushi and for live markets, where diners choose their entrees on the swim. Park works with both foreign and domestic markets.

A 4-pound flounder fetches premium prices in Japan, Park says. A 2- to 3-pound flounder has the most general market appeal. But a flounder of the minimum legal size in North Carolina weighs only about 1 pound.

"That's not enough for one family or even one person," Park says.

Park is nurturing about 8,500 fish, or about 12,000 pounds, segregated by size into two large tanks and three smaller ones. He buys fish in season from local fishers, who stack the flounder from their nets into trays and tanks on the trawlers.

Park pays about 40 percent over the market price because of the extra work and gentle handling that live flounder require. This has helped his operation gain quick acceptance in the traditional fishing community.

He holds and feeds the flounder for a one-year "growing season." The flounder eat about 300 pounds of chopped bait every afternoon. Park will try twice-daily feedings in hopes of speeding the fattening process.

"I love my feeding time," he says. "That's my most excellent time."

But Park also has encountered plenty of problems. "I have a lot of time in, a lot of mistakes," he says.

Of the flounder brought into his tanks, 30 percent die before going to market. That, he says, is a lower percentage than when he started. Most deaths occur in the first two weeks, likely from stress or injuries incurred during catching and handling.

Park also has combated such problems as parasites, which spread quickly among confined fish. He and two workers are at the tanks at all hours to head off trouble. He keeps constant vigil at the pumps and pipes that keep water flowing through the tanks. He also monitors the water's oxygen level and cleanliness.

"We're like the motel business," he says. "Clean every day, feed every day."

Despite setbacks, some of which the grant helped mitigate, Park has successfully fattened flounder for discerning markets in Asia and several large cities in the United States. Flounder bound for Japan are driven to Dulles airport for a non-stop passenger flight to Tokyo. The flounder go on ice at the fish market within 30 hours — and are on the menu that evening. Tank-to-table time is less than 36 hours.

Park's maximum annual production capacity is about 30 tons. He wants to double that — and to try fattening some flounder to premium weights of 4 pounds or more. Both aspirations could increase profits, but he says that isn't his only motivation.

"I want to prove this project," he says. "The money is not that important."

Wachovia Bank recently approved a credit line for Park's operation. Bank backing is a welcome indication that flounder fattening is a viable project, Daniels says.

"What we don't know yet is the economy of scale," he says. Preliminary findings are heartening, but the sheer number of flounder required to earn a profit would probably preclude most pound-netters from setting up tanks to fatten their catch.

"It looks like it's going to take a lot of fish to make any money," Daniels says. ■

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Holiday Greetings

The holidays are upon us, a time when families often come together and communities celebrate. Across eastern North Carolina this year, the strength of families and communities takes on a new importance. From Smithfield to Southport, Goldsboro to Greenville, Kinston to Kitty Hawk, many families are still picking up the pieces after Hurricane Floyd blasted through on the heels of Hurricane Dennis.

The combined storm damage is astounding: Dozens died as floodwaters swept through entire towns. The economic tally reaches into the billions of dollars in damage to homes, schools, businesses and farms. Clean-up will take months. The economic and emotional recovery will take even longer.

Along the coast, Sea Grant extension staff members are working with residents as they cope with the storms' aftermath. Communities on the southern coast felt the storm surge. Other spots along the sounds had flooding. Many businesses lost income as major highways were closed or fishing areas were inaccessible.

The environmental impact of the storms is a top priority for many Sea Grant researchers. They are looking at short- and long-term effects of the storms on coastal ecosystems. As inland rivers flooded, scientists were already gathering water samples.

In particular, funding from the state and national Sea Grant programs will allow scientists to monitor nearshore ocean waters, which showed early effects from the floodwaters.

In addition, ongoing Sea Grant research projects on the state's coastal rivers and estuaries are now considering storm-related factors.

Coastal residents are well aware of the power of hurricanes and storm surges. They are used to helping each other pick up the pieces after storms.

But with Floyd, much of the damage was from inland flooding, with water levels in places like Rocky Mount and Tarboro well above the 500-year-flood estimate. Within days of the storm, coastal residents were heading inland with ice, food and equipment.



"Although our coastal areas and commercial fishing families are also victims, most are extremely fortunate to have been spared what many of the other inland communities are going through," explains Jerry Schill, executive director of the North Carolina Fisheries Association. The fishing families delivered ice and organized a fish fry to raise funds.

Relief efforts continue. Many *Coastwatch* subscribers undoubtedly have already offered contributions. In addition to efforts by the American Red Cross, the Salvation Army and other charities, the state has established a special fund. Checks may be sent to:

HURRICANE FLOYD DISASTER RELIEF FUND
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One hundred years ago another big storm changed a cluster of coastal communities. The storm prompted the last permanent residents to move from Diamond City on Shackleford Banks to Harkers Island or the "Promised Land" in Morehead City. In this issue, Ann Green visits with descendants of those families, who gathered for a reunion earlier this year.

This story of strong family heritage and community identity fits this holiday issue — our last issue of *Coastwatch* in the 1990s. We also take this opportunity to look ahead, as we showcase young scientists who may hold the keys to scientific discoveries in the next century. And we look at water quality and inlet dynamics, issues likely to remain on the forefront of North Carolina's coastal agenda for decades to come.

Stories from the past. Bragging about the kids. Planning for the future. Add in some great holiday seafood and Sea Grant gift ideas. I think we have all the makings of a holiday gathering for the extended family of North Carolina Sea Grant.

So, have a seat. Relax a bit before you ring in the year 2000. ▣

Katie Mosher, Managing Editor

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Coastwatch

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Downriver: Scientists Assess Post-Floyd Water Quality

Hurricanes Dennis and Floyd devastated North Carolina communities this summer, but the storms' long-term environmental effects are still unknown. Researchers share their early findings and look to the future. 16

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The Catch: Catch and Release: Circle Hooks Round Up Giant Tuna ... And Let Them Swim Away Again

The circle has long been considered a perfect shape, but local fishers have only recently discovered the amazing efficacy of the circle hook. Renée Wolcott Shannon reveals the secrets of this improbable tackle and ponders the allure of catch and release. 26

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Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports several research projects, a 12-member extension program and a communications staff. Ron Hodson is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina. *Coastwatch* (ISSN 1068-784X) is published bimonthly, six times a year, for \$15 by the North Carolina Sea Grant College Program, North Carolina State University, Box 8605, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095. E-mail: kmosher@unity.ncsu.edu. World Wide Web address: http://www2.ncsu.edu/sea_grant/seagrant.html. Periodical Postage paid at Raleigh, N.C.

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*Front cover photo of
Shackleford Banks and
table of contents photo of
Cape Lookout lighthouse
by Scott D. Taylor.*

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COASTAL TIDINGS

Gifts for Coast-lovers

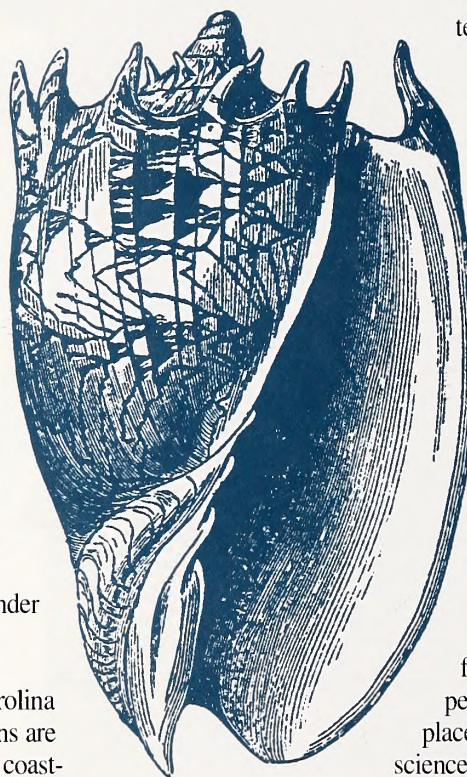
Look again at your holiday gift list and you may recognize a trend: Your family, friends and co-workers love the North Carolina coast.

One could spend the whole day collecting seashells. Another keeps a sailboat just off the Intracoastal Waterway. All appreciate the strong history of coastal communities and ponder the future of delicate ecosystems.

Many North Carolina Sea Grant publications are popular for just such coast-lovers. Here are a few.

- ***Seashells of North Carolina*** allows even the most casual shell hunter to identify a precious find. The 132-page book includes color and black-and-white photographs and descriptions of more than 250 shells. The guides — UNC-SG-97-03 — are \$12 each.

- ***Shifting Shorelines: A Pictorial Atlas of North Carolina Inlets*** offers both geology and history lessons as readers take a tour of the state's 22 inlets. Chronological photographs and



text trace the changes over time. The 50-page, large-format books — UNC-SG-99-07 — are \$15 each. For more information on North Carolina inlets, turn to page 24.

- Travel the length of the North Carolina shoreline with ***Coastwatch***, finding unique personalities and places, cutting-edge science, and updates on

Sea Grant extension and education projects. Annual subscriptions — six issues per year — are \$15. Gift forms are in the center of the magazine.

A list of other Sea Grant publications can be found on the Web at www2.ncsu.edu/sea_grant/seagrant.html.

To place your order, send a check to North Carolina Sea Grant, NC State University, Box 8605, Raleigh, NC 27695-8605. Please include the publication name and number. For more information, call 919/515-9101. — K.M.

In the Next Issue of *Coastwatch*

One of the nation's original stations for the U.S. Lifesaving Service is getting a new life thanks to volunteers on Hatteras Island.

Check in on the renovations by the Chicamacomico Historical Association, Inc. For those of you who like the adventure of sea rescues, our Book Market section will offer invigorating selections for wintertime reading.

Mysteries of Microorganisms

Why are harmful algal blooms toxic and how do they pose a health threat to fish and humans?

North Carolina Sea Grant researchers and other experts address the ecological and health concerns of *Pfiesteria piscicida* and other harmful species in "Nature Out of Balance," a two-part documentary that aired in August on the University of North Carolina Television.

The scientific detective story follows researchers to North Carolina rivers and sounds to probe the secrets of mysterious

microorganisms. The first segment examines the scientific context of harmful algal blooms, which are spreading geographically and occurring more frequently. The second show deals with human health effects, particularly those associated with *Pfiesteria*.

The program is a co-production of UNC-TV, North Carolina Sea Grant and the National Institute of Environmental Health Sciences. Video copies of the series are available from Sea Grant for \$10. Call 919/515-9101.

— A.G.



Alison Davis

Discover Diverse Wildlife at Buckridge Reserve

Roam a vast swamp forest for a glimpse of large black bears. Watch red-cockaded woodpeckers perch on pine trees. If you are lucky, spy an endangered red wolf or American alligator.

This diverse wildlife can be found in various habitats at Buckridge Coastal Reserve along N.C. 94 near Columbia. The site, which stretches over 18,000 acres, is the first and largest inland reserve among the nine components of the N.C. Coastal Reserve.

"This represents the coastal reserve's first mainland site," says John Taggart, coastal reserve coordinator for the N.C. Division of Coastal Management. "It includes an example of a low-salinity estuarine habitat."

The reserve encompasses a vast area of swamp forest, including 5,000 acres of Atlantic white cedar — half the documented remaining acreage of cedar in the state.

The state purchased the land from Primland Ltd. with \$6.8 million in grants from the Clean Water Management Trust Fund, the National Heritage Trust Fund and the Coastal Wetlands Fund, administered by the U.S. Fish and Wildlife Service. The North Carolina chapter of the Nature Conservancy negotiated the purchase on behalf of the state.

— A.G.



Scott D. Taylor

Cape Lookout Lighthouse Renovation

At the historic Cape Lookout lighthouse, the diamonds are beginning to look a little rough. Inside the 15-story tower, the mortar has cracked, and the metal has rusted. During storms, water seeps in.

To preserve the distinctive black and white diagonal checkerboard landmark, the Coast Guard started renovations in July.

"We are doing interior renovations," says Chief Nick Johnston of the U.S. Coast Guard. "Large chunks of bricks have fallen from the tower. It had become unsafe for

personnel. We hope to get the interior in better shape. Our work has been thrown back because of Hurricane Dennis."

During the \$71,400 renovation, the bricks and metal are being repaired, and the lantern is being preserved.

The last time the Coast Guard worked on the lighthouse was in 1995, when it repainted the traditional black and white diamonds.

Throughout the renovations, the light will shine from the beacon.

— A.G.

A Forest for the New Millennium

If a tree falls in the forest with no one to hear, does it make a sound? The Zen riddle may be unanswerable, but as Pocosin Arts knows, trees being felled in the forest can definitely make an impact.

For centuries, the Atlantic white cedar — a juniper valued for its straight, lightweight and resilient wood — was heavily harvested for use in shingles, house trim, channel markers and boats.

Now the globally endangered cedar's plight is being heard. On the first day of spring, schoolchildren will be planting 7,000 Atlantic white cedars on a 7-acre tract of the Pocosin Lakes National Wildlife Refuge south of Columbia in Tyrrell County.

A unique clay marker will be planted with each tree to share this moment in history with future generations. The resulting woodland will be a demonstration forest for environmental education.

The planting of the millennium forest is a fulfillment of the vision of Pocosin Arts, a nonprofit organization "connecting culture to the environment through the arts." A pocosin is an upland south-eastern swamp where Atlantic white cedar forests once filled an important role, stabilizing streamflows, purifying water and providing habitats for birds and other wildlife.

But the project — 7000 Juniper — is more than an attempt to save an endangered plant species. It is an integration of art and science to improve quality of life. The yearlong project will focus on wetland ecology and its protection.

Pocosin Arts also plans to have an environmental art exhibit at the East Carolina University School of Art, photographic and bird-watching excursions into

juniper woods, a demonstration of shad-boat construction, and a decoy exhibit and carving workshop.

The project offers an opportunity to consider "how we might restore the environment," says Feather Phillips, executive director of Pocosin Arts. The project also encourages us "to think about using art to express this time in our culture's life — where we've been and where we're going," she says.

Weyerhaeuser Corporation will donate seedlings. Artists will design the forest space, balancing densely planted trees with open space to create an environmentally functional ecosystem with contemplative areas. Supporters can buy bronze memorial plaques to honor individuals or groups.

For more information about 7000 Juniper, call Phillips at 252/796-2787 or e-mail pocosinarts@hotmail.com.

— C.H.V.

AROUND THE NETWORK:

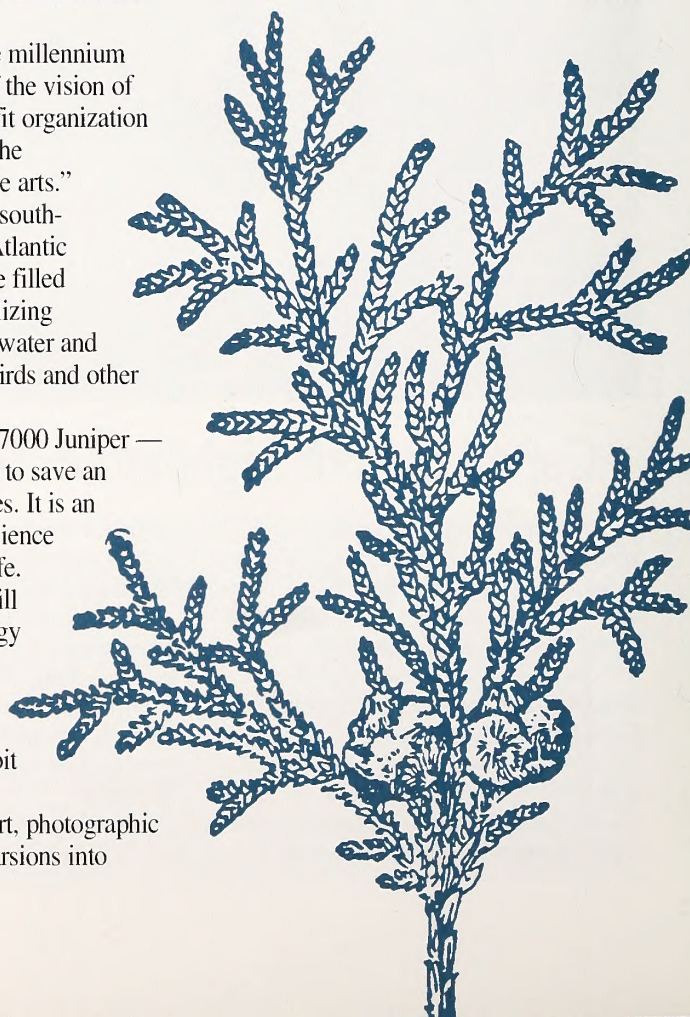
New Marine Mammal Guide

Whales. Dolphins. Seals. Loggerhead turtles. These sea creatures have long fascinated kids of all ages.

Now Rhode Island Sea Grant has a new *Guide to Marine Mammals and Turtles of the U.S. Atlantic and Gulf of Mexico* to help you identify 45 species. The guidebook, written by Kate Wynne and Malia Schwartz, has full-color illustrations and photos, as well as distribution maps.

Single copies of the guidebook are \$25. Make your check or money order payable to Rhode Island Sea Grant/URI and mail it to Rhode Island Sea Grant, Communications Office, URI Bay Campus, Narragansett, RI 02882. Discounts are available on larger quantities.

— K.M.



Monitor Expedition Successful

During a 25-day summer expedition, the 1999 *USS Monitor* diving team collected data and video footage that can be used in salvaging the historic shipwreck's engine. The famous shipwreck is 16 miles off Cape Hatteras.

"Overall we were quite successful," says John Broadwater, manager of the *Monitor* National Marine Sanctuary at the National Oceanic and Atmospheric Administration (NOAA). "Our main goal was to collect information on the engine space to use next year in recovery efforts. Since the shipwreck is upside down, the engine is vulnerable and has to be removed. Eventually, we will need to

recover the turret and guns" because of their historical value.

The *Monitor* was one of the first steam-powered, ironclad battleships, and researchers say strong currents are threatening to destroy the famous shipwreck.

During the expedition, the divers encountered a heavy layer of silt and only recovered a few artifacts, including an engine part, steam piping, a pharmaceutical bottle and mustard bottle. The expedition was a partnership between NOAA and the National Undersea Research Center at the University of North Carolina at Wilmington. — A.G.



N.C. Division of Archives and History

Old Buck Lives On

Come January, much of the world will be caught up in the year 2000.

But in Rodanthe, folks will gather for an oyster roast that celebrates the heritage of "Old Christmas."

They will honor the legend of Old Buck, a bull that, as one story goes, was the only survivor of a shipwreck off the Outer Banks.

The bull became so famous that he was honored at the town's holiday celebration. Upon his death, the community kept his spirit alive.

For generations, town leaders have donned a costume using steer horns and a blanket. "We used to ride on his back," says Joey O'Neal of Rodanthe. "My granddaddy would lead him in."

O'Neal's grandfather, the late John Herbert, was the keeper of Old Buck for more than 45 years. An oral history published by Cape Hatteras School in 1979 also describes earlier celebrations that included festive costumes and wandering minstrels.

Old Christmas officially falls on Jan. 5. Rodanthe expects to celebrate with an oyster roast, square dance and the arrival of Old Buck — led by John Herbert Jr. — on Jan. 8.

For more information on Old Christmas, call O'Neal at 252/987-2560. — K.M.

Tallying Floyd's Oceanfront Toll

The fury of Hurricane Floyd hit Brunswick County beaches with rushing water, eroding sand and floating debris. The combination of forces was just too much for some pilings supporting older cottages.

"It eroded two to four feet around each piling," says Spencer Rogers, North Carolina Sea Grant's coastal construction and erosion specialist. "There wasn't anything to hold it up."

Rogers surveyed the beaches immediately after the storm. He is now reviewing that data to determine the level of damage to buildings that meet current building codes for deeper, wider pilings.

In addition to the erosion, some of the supporting structures were also battered by floating debris — parts of fishing piers, pieces of buildings, even stop signs. In extreme cases, the debris was more than 20 feet in length.



Spencer Rogers

Rogers is working with state and federal agencies to document the building damage caused by this floating debris.

Even newer homes had damage to under-house storage areas, but that is to be expected, Rogers explains. The storage areas are built with breakaway walls that may be damaged during a storm surge, but allow the building

to maintain its structural integrity.

To learn more about breakaway wall construction, download a technical bulletin that Rogers prepared for the Federal Emergency Management Agency. On the Web, go to www.fema.gov/MIT/job15.pdf. Look for "Design and Construction Guidance for Breakaway Walls Below Elevated Coastal Buildings." You will need Adobe Acrobat software to read the file.

A more detailed technical report is also available from Rogers. Call 910/256-2083. — K.M.

Rekindling

DESCENDANTS CELEBRATE 100TH ANNIVERSARY

By Ann Green • Photographs by Scott D. Taylor

As soon as David Yeomans jumps off a boat onto the deserted shores of Shackleford Banks, he feels at home on the “holy ground.”

Thoroughly soaked from the bumpy boat ride across Barden Inlet, he walks barefoot across the sand, recalling countless memories of island visits.

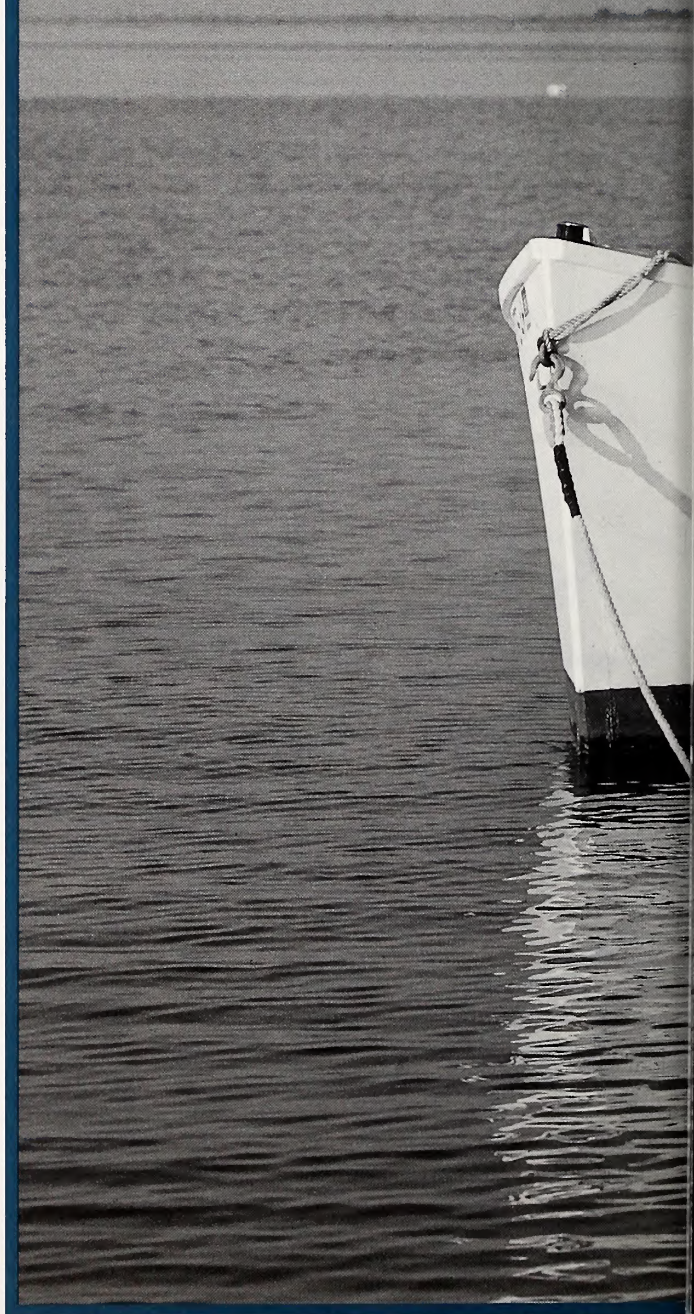
He remembers taking visitors to old whaling camps that once stood in the sand.

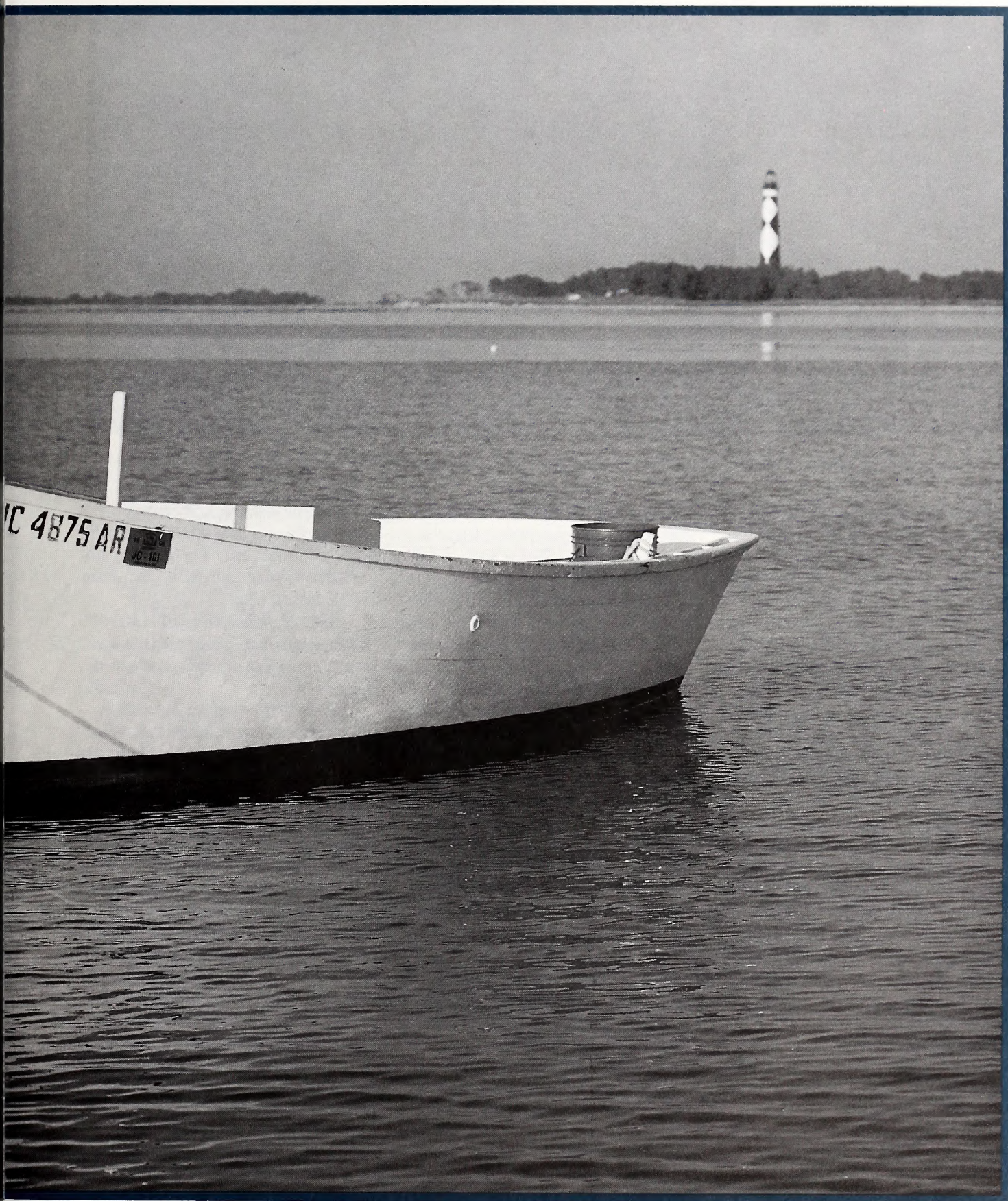
He remembers watching herds of wild horses wander through grassy areas that were once inhabited by Diamond City residents.

He remembers his father’s stories about the 1899 storm that forced whalers and their families to leave Shackleford Banks and Ca’e (Cape) Banks.

Continued

Memories: OF GREAT STORM







J.A. Rose enjoys the Ca'e Banks reunion.



Madge Guthrie tosses a memorial wreath into the water.

In 1899, the big one came," says Yeomans, 79. "The water came from the ocean and sound and covered all the banks and went in homes. People realized that it was time to leave the spot where they lived and loved so much."

Yeomans walks up a sandy hill, stopping at the only telephone pole left on the island. With a small crowd around him, he lays a wreath to commemorate the descendants of the Banks communities, including Diamond City — named for the diamond pattern on the nearby lighthouse.

The ceremony marks the 100th anniversary of the 1899 storm that forced families to leave thriving, close-knit communities and migrate to safer ground at Harkers Island and Morehead City. Today, Diamond City is a ghost town. Ca'e Banks, where the Cape Lookout lighthouse stands, also are deserted.

"We thank you for this day," says Yeomans, the retired postmaster at Harkers Island. "It's been a memorable day all day long. Now, Lord, we lay this wreath on this hallowed spot. We thank you for those who lived here, our families. Thank you for the countless memories that flood our soul."

Earlier in the day, more than 600 descendants and friends of Bankers had

gathered at the end of Harkers Island on Shell Point.

"This reunion

will help us keep our connections," says Barbara Guthrie Humphreys, whose mother wrote *Cartaret Love Song*, a poetry collection. "It's making you stronger. It's acknowledging who you are and where you are going."

Although Humphreys' ancestors left the island 100 years ago, she and her family still follow many traditions.

"Faith has been embedded in us," says Barbara's sister, Julie Guthrie Fulcher. "Our ancestors also brought over our preference for food — love of seafood, collard greens, fried hogfish, sweet potatoes, dumplings and fried cornbread."

As the descendants gather under white tents, they feast on traditional dishes, including clam fritters, light bread biscuits (yeast rolls), oatmeal hurricane cake, collards and dumplings.

"Thoughts of bringing together all the family connections of the Banks communities first surfaced when I read *Somerset Homecoming* many years ago," says Karen Willis Ampsacher, reunion organizer and Core Sound Waterfowl Museum director. "That story of a

commitment to family and heritage challenged me to think of our own scattered kinfolk and how wonderful it would be to bring them all together again — for the first time."

Since music is an important part of the Banks heritage, the reunion participants sing a variety of traditional and gospel songs.

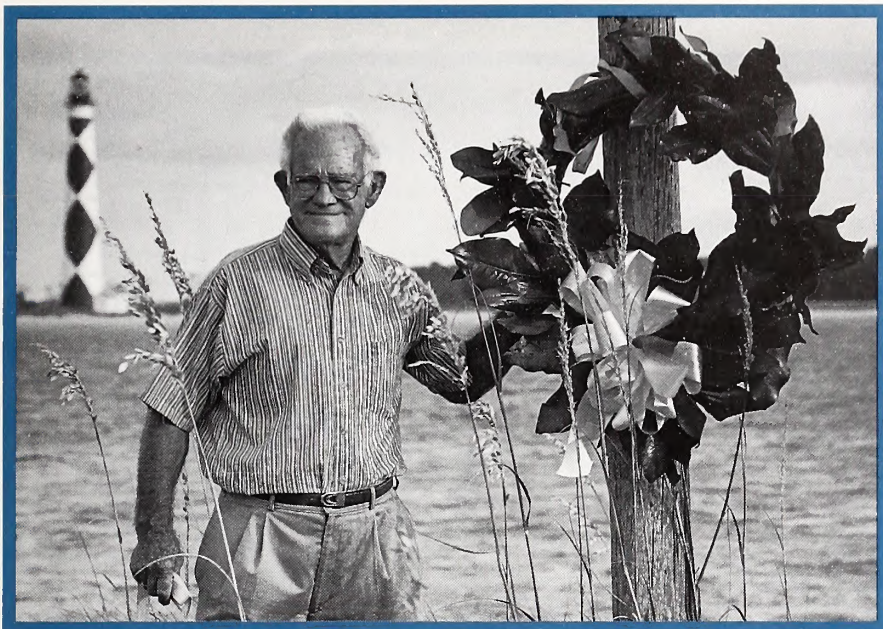
While standing under an old cedar tree, Yeomans commands an audience while singing "The Booze Yacht," a song about finding high-quality whiskey from a rumrunner that ran aground on Cape Lookout. Nicknamed the "Harkers Island national anthem," the song was set to the tune of "The Sidewalks of New York."

"I was 5 when they got together in my father's house and wrote the song," he says.

Later in the afternoon, the descendants gather at the Church of Jesus Christ of Latter-day Saints cultural hall for a couple hours of singing, clapping and readings.

"It is fitting that we are one hour behind schedule," says Joel Hancock, the reunion's master of ceremonies. "Time didn't mean anything to our ancestors."

At times, the service becomes solemn. When Annette Fluhart Willis sings "I Stood on a Hill — on Shackleford," many descendants' eyes fill with tears.



David Yeomans places a wreath on Shackleford Banks. Cape Lookout is in the background.



Karen Willis Amspacher

"It was very emotional," says Yeomans. "It was homecoming and about my people."

Throughout

the day, descendants also swap stories about whaler Billy Hancock and other Bankers.

Hancock's great-great-grandson, Jonathan Willis, loves to tell a story about his ancestor's whale dream.

During the last part of the season, a whale appeared near his great-great-grandfather's fishing camp.

"They sent the crew to harpoon the whale," says Willis. "That night, my great-great-grandfather had a dream that the whale washed ashore at Cape Lookout point, 10 miles from where he lived. He got up in the middle of the night and woke his crew. Then he took off to find the whale. By the time they got to the point, the whale had washed ashore."

Fortunately, his crew had followed and saved the whale from floating away, adds Willis. After it was over, they came back to Diamond City for a big square dance.

The whaling industry thrived in the 1850s on Shackleford Banks, known for its well-organized whaling camps.

"It was shore-based whaling," says

Sea Grant researcher and East Carolina University anthropologist David Griffith. "It was never pelagic whaling like in *Moby Dick*, where they followed the whale around the world. At the end of the season, they moved on to mullet fishing and clamming, gigging flounder, crabbing and farming."

Griffith says one fascinating characteristic of North Carolina whalers was naming the mammals.

"Whales were named for their captors (Lee Whale, Tom Martin Whale), for the weather (Cold Sunday, a day so cold, it was said waterfowl froze in flight), or for unique circumstances surrounding their capture," writes Griffith in his new book, *The Estuary's Gift: An Atlantic Coastal Cultural Biography*. "They were able to name each whale because they caught only a few each spring, and each landing had something memorable about it, something unique."

These whalers had a unique identity and language, "spawning the distinctive Tidewater English dialects reminiscent of Elizabethan England," he says. The descendants have a distinct speaking style, using "pizer" for "porch" and "ca'm" for "calm water."

Most of the whaling took place at Diamond City, which had one distin-

guishing feature — a large sand dune called "Yellow Hill." The last whale was killed in 1909, writes David Stick in *The North Carolina Outer Banks: 1584-1958*.

Several other communities dotted the island. Just to the west of Diamond City was Bell's Island, known for its large and bountiful wild persimmon trees. The westernmost part of the Banks was known as Wade's Shore, the most densely wooded part of the island.

East of Diamond City, across the small "Drain" that eventually became Barden's Inlet, was the small settlement of Cape Lookout, also called Cape Hill.

Life centered around the large lighthouse. "I remember going to the lighthouse when I was 5," says Yeomans.

"The light shined through the window. Back then, you could see all the way from Shackleford to Morehead City."

The wrath of

two storms in 1896 and 1899 ravaged the island. The last storm did the most damage to Shackleford.

"There was water over everything, with just few of the bigger sand hills sticking their tops out, and the houses mostly looking like houseboats,

Continued



Ca'e Banks descendants pay tribute to their families during a service at Shell Point on Harkers Island.

surrounded by sea water," writes Stick. "It washed over the stones in the graveyards and uncovered the bones of the folks buried there; it killed most of the big trees, and flooded the gardens with salt water and cut the beach down so low in spots that almost every high tide would come over."

After the storm hit, residents scurried to find new places to live. They moved across the sound to Harkers Island. They also migrated to a five-block area in Morehead City, dubbed the "Promised Land" because it was much safer than the Banks. A few families went to Marshallberg and Bogue Banks, to a place now known as Salter Path.

"They took houses apart and stacked them on boats and took them to the Promised Land," says Humphreys. "As some of the Bankers were leaving, they sang 'I'm Bound for the Promised Land.'"

Phyllis Gentry lives in Morehead

City in a restored white frame house brought over by Kilby Guthrie in 1892. "The house was brought over by a sharpie — a flat-bottom boat — from Diamond City when the weather got bad," says Gentry.

By 1900, most residents had vanished from Shackleford and Ca'e Banks. As they arrived on the mainland and Harkers Island, they brought with them their affinity for working the water.

On Harkers Island, many descendants became boatbuilders and fishers. The boatbuilders developed a special style, known as the Harkers Island or Carolina design, recognized for its wooden hull and flared bow.

"My ancestors brought with them some of the traditions of old English boatbuilding," says J.A. Rose, a model boatbuilder. "Some of the designs came from old England in the 1500s."

For years, Rose, who is nicknamed "Captain" and wears a white sailor hat, worked as a fisher and boatbuilder.

"I started fishing for a living when I was 12 years old," he says. "It was dumped on me. I have done a lot of commercial fishing. I got out about 15 years ago and sold my boat."

Since retiring from fishing, Rose has built more than 3,000 model boats — from traditional Harkers Island workboats to old-time oyster schooners. He builds the boats at his Harkers Island home about 150 feet from Back Sound.

Today, there are only a handful of full-time boatbuilders and commercial fishers left on Harkers Island.

Most of the descendants on the island and across Carteret County have gone on to other occupations, including teaching, the ministry and insurance.

Some, like Willis, a hairdresser in Morehead City, also work in traditional crafts. During the fall and winter, Willis carves gunning birds that he displays at shows along the East Coast. Carving decoys is a Down East tradition.

"I like the fact that it puts me back in a time that has disappeared," he says. "Even though I don't go out and shoot, I like to look for ducks. My birds can be used for hunting, but they are also upgraded and painted more realistic than old decoys."

Bankers' descendants still follow the practice of taking care of each other when they are sick or in need of food.

"I have a large extended family on the island," says Hancock. "We are all related. I always feel at home no matter where I am on the island. There's an expression 'it takes a village to raise children.' It takes a community to raise each other's children."

For years,

the Bankers' descendants returned each summer to two-room camps on Shackleford, where they fished and carried on traditions. The simple camps had no electricity. Usually, there was a gas stove.

"You usually sat on the front or back porch, depending on how the wind was blowing," says Amspacher.

"The camps were very communal. Everybody's door was open. People got together and cooked. For lunch, you might have a pot of butter beans. For supper, clams, and watermelon after supper."

One favorite activity on Shackleford's east end was summer horse roundups or pony pennings.

"Up until the mid-'70s, we would go to a horse penning every summer," says Hancock. People herded the horses and branded them with a hot iron.

Since most of the residents on Shackleford Banks had no deeds to the camps, they were forced to leave when the National Park Service preserved the area as the Cape Lookout National Seashore. Although the national seashore was authorized in 1966, Bankers didn't abandon the camps until they were forced to leave.

"December 1985 was a sad month in the life of Harkers Island people,"

writes Suzanne Yeomans Guthrie in *Island Born & Bred*. "Tears ran freely and hurts were deep, as smoke curled on the horizon from camps being burned by their owners."

"With that smoke went memories and feelings that could never be replaced. It was the end of a way of life."

In the Cape Village, some owners struck a deal with the park service to lease the land. Yeomans, who owned the old Lifesaving Service boathouse, negotiated a 25-year lease on his cabin in 1977. The house sits in a sandy swale behind dunes pocked with remains of World War II machine-gun nests.

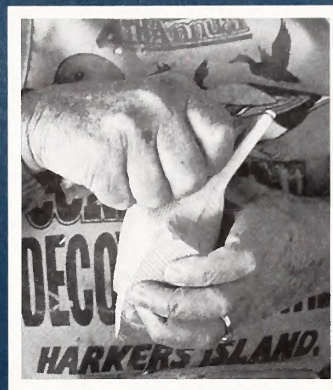
"I have three years left on the lease," says Yeomans. "I'll probably cry myself to death if I have to give it up. I was born over there. Hope they extend the lease year to year."

National Park Service officials and the community now work together to preserve local traditions. In 1993, park officials and members of the Core Sound Waterfowl Museum negotiated a 30-year lease for the museum on 16 acres of land at Shell Point. The first phase of the museum will open in summer 2000.

"The Core Sound Waterfowl Museum is the Down East community's permanent tribute to its history and our way of holding on to the unique cultural heritage of Core Sound," says Amspacher. "We are fortunate to have the National Park Service's support. As owners and protectors of much of the land around Core Sound, it is critical that we work together to preserve these natural and cultural treasures."

Even families who lost homes at Shackleford still have a strong spiritual connection to the island. They often go back to fish, reminisce and leave their footprints in the sand.

"I still go to Shackleford and Cape Lookout to fish," says Willis. "I walk on shore to make sure it is still here. There's still a strong physical connection between us and the Banks. It's like a magnet that pulls us there. If you don't visit there, you lose the energy." ☐



New Core Sound Museum Opening in Summer

Down East on Core Sound, community traditions thrive — from wooden boats at Harkers Island to intricately carved wooden decoys.

The Core Sound Waterfowl Museum will showcase the wooden artifacts made from the community's natural resources, as well as the hunters, fishers and others who have lived along Core Sound for centuries.

Located on 16 acres of maritime forest at the end of Harkers Island, the new facility is scheduled to open next summer. The shell of the building was completed this fall.

"We are unique in North Carolina," says Karen Willis Amspacher, the museum director. "Our overall theme is the interpretative relationship between the cultural and natural environment."

The museum will include a 4-acre pond, educational facility and numerous exhibits. For more information, call 252/728-1500.

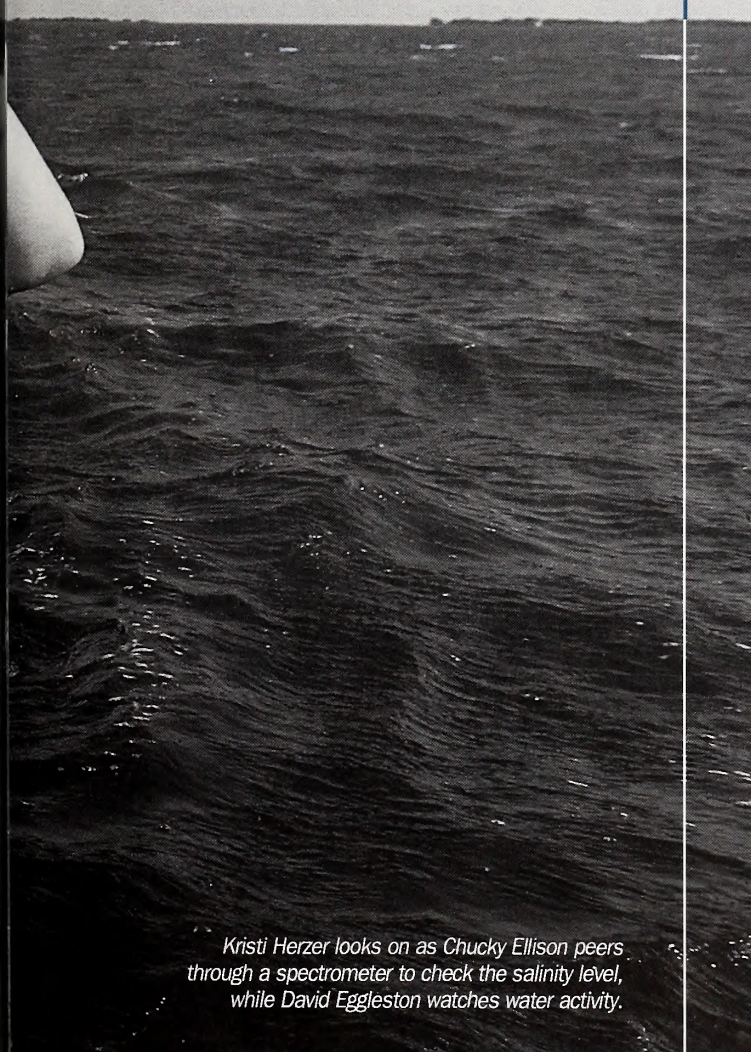


Budding Scientists:

Teens Join Cutting-Edge Research

By Ann Green

Photographs by Michael Halmnski



Kristi Herzer looks on as Chucky Ellison peers through a spectrometer to check the salinity level, while David Eggleston watches water activity.

Kristi Herzer stands knee-deep in the Pamlico Sound near Oregon Inlet, using a vacuum-like hose to suck up aquatic creatures from sea-grass beds.

"After you finish the sweep, use the dip net to make sure there are no more jumping crabs," yells Lisa Etherington, a North Carolina Sea Grant researcher and NC State University graduate student.

With the help of NC State researchers, Herzer, a Manteo High School senior, dumps the collection on board a small boat. Then she examines the samples — from juvenile crabs as small as a quarter to tiny shrimp.

Herzer finds her first field research experience "fun and exciting. I didn't realize there are so many living creatures in sea-grass beds."

From August to October, Herzer and 26 other budding scientists from Ocracoke School and Hatteras, Manteo, Mattamuskeet and East Cartaret High Schools gather samples each day for North Carolina Sea Grant researcher David Eggleston's study on juvenile crabs.

"It is interesting to find results that might be in a textbook some day," says Manteo High School senior Chucky Ellison.

Since 1995, Eggleston has been involving high school students in his ongoing study on the recruitment of juvenile blue crabs. The study is funded by the National Science Foundation, North Carolina Sea Grant and the Z. Smith Reynolds Foundation.

The integration of high school students has been a "win-win situation" and "critical to the success of this large-scale study," says Eggleston, associate professor of marine sciences at NC State.

"With their help, we have identified unique and until now undocumented nursery habitats for early juvenile crabs, as well as the role of hurricane storm surges and northeasterlies on transporting large numbers of settlement-stage blue crabs into the Pamlico and Croatan sounds," he adds.

"After Hurricane Dennis, we had a huge peak in blue crab settlements at Englehard in Hyde County. Through this experience, the students gain hands-on experience in the scientific method and increase their knowledge of coastal resource issues."

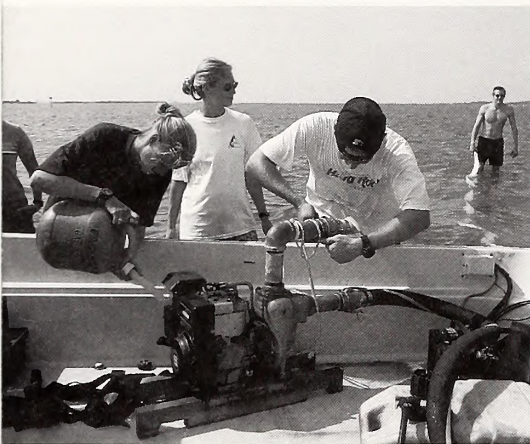
The students collect samples on docks as well as in sea-grass beds in Pamlico Sound and seven other coastal locations. On the docks, the students pull an artificial settlement habitat out of Oregon Inlet. By using air-conditioning filter material to collect the crabs, the scientists are simulating a natural habitat. Then the students rinse the samples, strain the water and put the samples — which are sometimes as small as fleas — in jars that go to a lab.

"The data will give researchers information on the number of crabs moving through the water column," says Eggleston. "Blue crabs are the dominant predator in North Carolina's estuary system" and the state's top commercial fishery species.

During the collections, the students develop camaraderie with researchers and get a close-up of marine life. While standing on the sea-grass beds, Etherington guides the students in the research process and quizzes them about the different stages in a crab's life cycle.

C o n t i n u e d

"We want the students to realize that scientists aren't all geeks," says Eggleston. "Research can be fun. The students get a chance to joke and relate to researchers. Lisa is like a guidance counselor. They phone her about all sorts of different issues."



Lisa Etherington and Derrick Blackmon prepare the suction pump.

Through a national education reform effort, scientists are being encouraged to mentor high school students.

"This arrangement provides students with first-hand knowledge of how research works," says North Carolina Sea Grant marine education specialist Lundie Spence. "This may bring more people into science careers. The university scientists also benefit by extending the value of their investigations into school systems. This has a ripple effect by getting teachers involved in sharing new knowledge."

Many of Eggleston's students have gone on to major in physical or earth sciences at major universities.

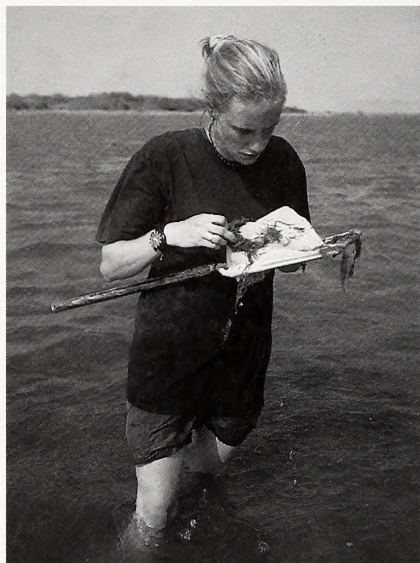
"I have some amazing stories about the program turning on students," says Eggleston. "One student was ready to drop out of high school. After working on the project, she decided to major in wildlife management at a major university."

Herzer's research job has confirmed her desire to pursue a science career.

"It's been a good experience," she says. "Now I know what hands-on

experience is about. I have decided to major in chemistry or a biological science."

However, Ellison finds research work too tedious and repetitious to do it for a living. "Although it has been a great learning experience, I will probably major



Lisa Etherington examines samples.

in computer science," he says.

In North Carolina, more high schools are offering marine science and aquaculture classes as electives.

"There is a tremendous interest in the environment and oceanography," says Bill Tucci, high school science consultant for the N.C. Department of Public Instruction. "Through the North Carolina Standard Course of Study — goals and objectives for the state's science curriculum — and the National Science Education Standards, students in grades K through 12 are being encouraged to become more environmentally aware."

In marine occupation classes at Pamlico County High School in Bayboro, students learn to navigate, tie a knot and read charts while on a 38-foot Harkers Island trawler.

"The class was more like a regular job than school because you got out and did things," says Allen Buck, a Pamlico High



David Eggleston sorts samples with students.

School junior. "I plan on going into the Coast Guard after high school."

Through a North Carolina Fishery Resource Grant, the students also have studied bycatch-reduction devices used to free unwanted fish or other catch not targeted by fishers.

"The research teaches them different aspects of ecology and the value of bycatch-reduction devices," says marine occupation teacher Bruce Morris. "It also gives them a chance to see how data is collected. We actually make a trawl. Sometimes, we come up with a better idea how to use the device more effectively."

Because of the success of the class, Pamlico High School initiated a marine biology class this year.



A juvenile blue crab is tiny.

"This class ties in with the marine occupation classes," says Morris. "We go out on the boat and collect different species of fish, crab and shrimp. The students get to see the different species alive and see how they are harvested," and measure the effectiveness of bycatch-reduction devices for weakfish and mackerel.

As the aquaculture industry has blossomed in North Carolina, more high schools are offering aquaculture classes.

In 1987, an aquaculture class was started at South Brunswick High School in Southport. The program has now expanded to include three levels of classes, including one for seniors at Brunswick Community College.

The school now has four ponds and a reservoir that were funded by the state's Fisheries Resource Grant program and others.

"It's a vocational program in which students learn about identifying fish, water quality, inventory, harvesting, transportation and other things related to fish farms," says Barry Bey, the program instructor. "Seniors help me with the operations of the farm and develop business plans and resumés."

This year, the program, which

focuses on three types of fish farming — food fish, sport fish and hobby fish — received the Governor's Economic Developer of the Year award.

"This program has been a feeder farm for the fish, farming and seafood industry,"



Kristi Herzer and Chucky Ellison process samples.

says Bey. "We have also educated the public about aquaculture and helped start a class at Brunswick Community College. More importantly, the program has helped students of all levels. It has given students with learning disabilities a chance to get a college scholarship."

Bey says that one of his biggest success stories is a young woman who had no interest in college until she began the program.

"The class helped to motivate her and gave her good work ethics," he says. "This young lady went on to graduate from a community college. Now she is majoring in marine biology and aquaculture at the University of North Carolina at Wilmington."

At Dixon High School in Holly Ridge, students in the aquaculture class maintain an oyster garden, where they check the salinity and oxygen content of

the water and compare growth rates.

"We use an inquiry-based approach," says Ed Hudson, a science and aquaculture teacher at Dixon. "We go out twice a week to Alligator Bay and to an adjacent bridge and take water samples. If there is plankton



Nathalie Reyns helps David Eggleston measure a blue crab.

in the net, we do a gas test in the lab for bacterial growth."

The students also keep logs on oxygen content, weather and temperature. "It teaches students an appreciation of nature," says Hudson. "When there are only 150,000 small oysters in the water and you can harvest only 20,000 oysters, we need to look at the mortality rate and what causes the oysters to die."

Through the class, students also develop an interest in science.

"In our first class, two students became commercial fishermen with large fishing vessels," he says. "Probably 20 percent of the class becomes science majors."

Hudson would like to see more programs like this in high schools.

"The class teaches students and the public an understanding of the marine environment," he says. "It helps people develop an appreciation for the problems associated with the marine environment. Our whole community is supportive of the program." ☐



Lisa Etherington, Nathalie Reyns, Geoffrey Bell and Chucky Ellison look at samples pulled from seagrass beds.

DOWNRIVER: Scientists Assess Post-Floyd Water Quality

By Katie Mosher

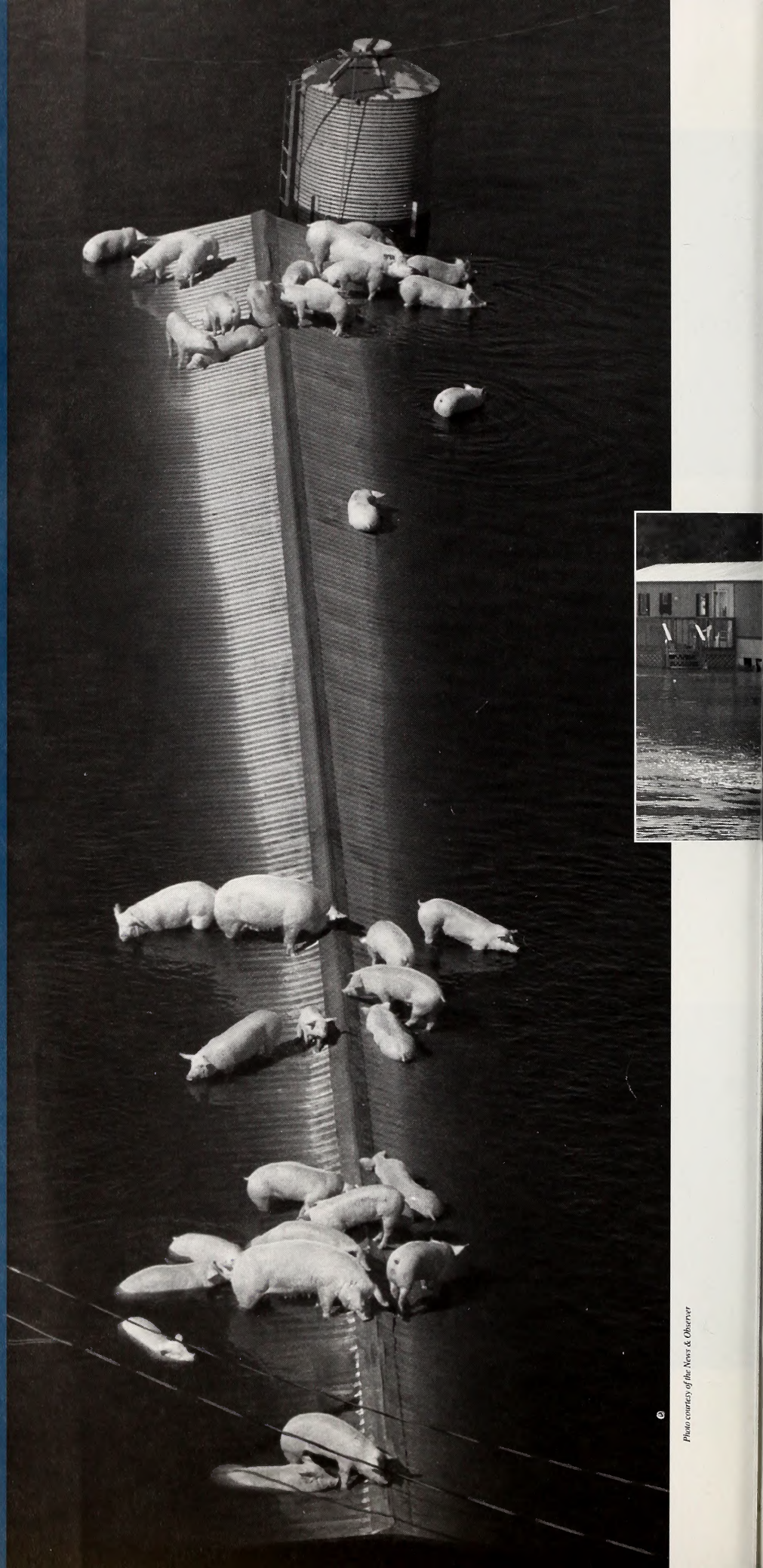


Photo courtesy of the News & Observer

Floodwaters from Hurricane Floyd clearly devastated dozens of eastern North Carolina communities, but what effect will the flooding have on coastal ecosystems?

Time will tell. But within days of the storm — which came on the heels of Hurricane Dennis — North Carolina Sea Grant researchers were already venturing into the swollen rivers to begin water-quality sampling.

flooding that caused some rivers to crest 20 feet or more above flood stage — was about half the depth of the river where it meets the sound.

“It is unprecedented in our experience to see that stratification that far downstream,” says Larry Crowder of the Duke University Marine Lab.

In fact, by early October, the floodwater plume was visible into Core

The post-Floyd sampling has been a cooperative event, not only among the university scientists in chemistry, biology and fisheries, but also for state agencies and participants in the N.C. Fishery Resource Grant program.

With funding from the resource grant program, the Cape Fear River Watch has conducted sophisticated monitoring since 1996, sharing the samples with Mike



Floodwaters inundated communities, leaving residents thankful for rescue.

Photo courtesy of the N.C. National Guard

“We’ve caught the leading edge of the floodwater plume, so we are in position to watch the effects develop,” says Larry Cahoon of the University of North Carolina at Wilmington. “Our ultimate aim is providing decision-makers the broadest information possible on the total environmental impact of this event.”

The first week after the storm, Cahoon and his colleagues documented lowered levels of dissolved oxygen and lower salinity in the Atlantic Ocean near the mouth of the Cape Fear River. They are continuing to sample not only the river, but also the open ocean miles from shore.

Farther north, early effects included six feet of fresh water the color of chocolate milk at the mouth of the Neuse River, an area that normally has a saline mix. The layer of fresh water — from

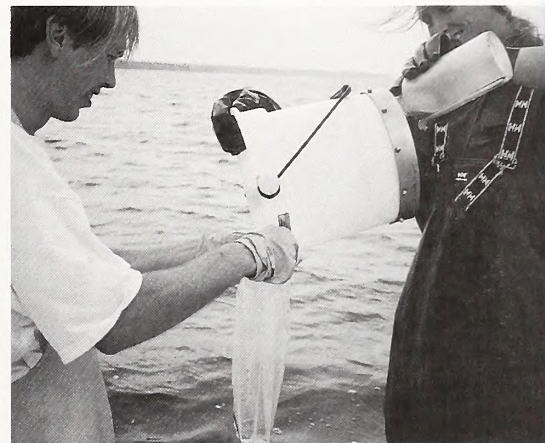


This earthen dam fell victim to raging water.

Photo courtesy of the News & Observer

Sound and the Pamlico Sound — both critical habitats for North Carolina fisheries — according to Hans Paerl of the University of North Carolina Institute of Marine Sciences, who is coordinating his sampling with Crowder and Duke scientists.

“This is not likely to be a one-year event. We expect it to play out over several years,” says Paerl. For instance, because of the large amount of fresh water that has moved into the sound, researchers will be watching for freshwater algae, such as blue-green algae, once the spring sun warms the sound.



UNC-Wilmington researchers gather water samples.

Jim Bahen

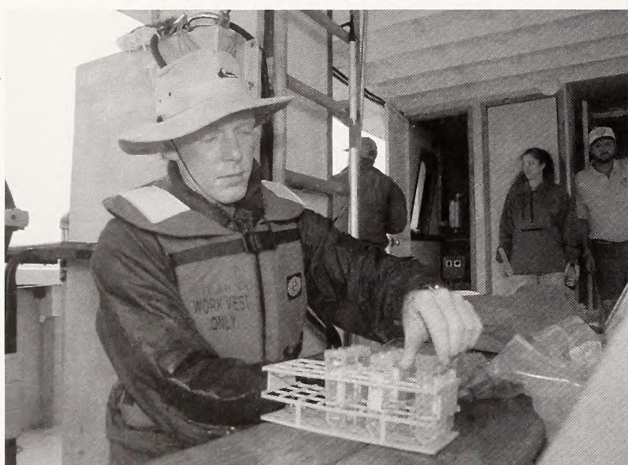
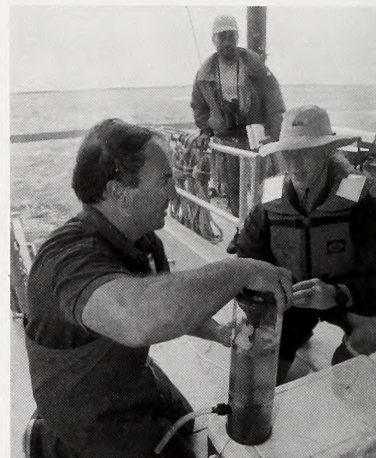
Mallin of UNC-W. The database shows the typical nutrient, salinity and oxygen levels or baseline, as well as the effects of Hurricanes Fran and Bonnie.

On sampling runs after Floyd, riverkeeper Bouton Baldrige, UNC-W researchers and Sea Grant fisheries specialist Jim Bahen noted other changes.

On the Northeast Cape Fear River, small flatfish known as hogchokers had come up to the surface seeking more oxygen, Bahen says. The survival tactic was not foolproof. The fish — normally bottom-dwellers — became easier prey for nearby gulls.

The oxygen issue is expected to be a factor for some time. As the floodwaters move downriver, they carry large amounts of organic material, including waste from flooded sewage plants and farm lagoons

C o n t i n u e d



CLOCKWISE FROM TOP LEFT: Samples of water from the Cape Fear River and the Atlantic Ocean are ready for testing. Larry Cahoon holds an indicator for the turbidity of the water — in some areas, visibility was around 35 cm. Alessandro Bocconcelli, left, director of operations for UNC-W's Center for Marine Science Research, and marine science graduate student Jason Hales prepare a water sample. Hales caps samples from the Atlantic Ocean. Cahoon looks at a water sample from the Cape Fear River.

Photos by Erin Wall

and other vegetative matter. When the current slows, the matter settles.

"It will be there, and it will rot," says Barbara Doll, Sea Grant's water quality specialist.

That process of decay will consume large amounts of oxygen — and fish need oxygen to survive. Extremely low levels of oxygen can lead to fish kills.

Other effects may be prolonged. For example, fish that are already stressed by low oxygen levels may become more susceptible to disease, says James Rice of NC State University.

Other studies will assess the levels of pathogens or heavy metals. Mark Sobsey of UNC-CH is looking at both bacterial and viral effects. He will share his results

with the state's shellfish sanitation officials. His studies will go beyond tests required by state statute to declare swimming areas and shellfish beds open.

Martin Posey of UNC-W says that his database, which includes results after past hurricanes, enables him to predict Floyd's impact on the overall estuarine ecosystem. "After each storm there seems to be a cumulative effect on the benthic community — the base of the food web," he says.

The extended visit from Hurricane Dennis, combined with the effects of Hurricane Floyd, also took a toll on sea-grass beds that serve as nurseries for blue crabs. "We can't find any sea grass in Point Harbor," David Eggleston of NC State says of his research site near Currituck.

His research after Hurricane Fran showed that so many crabs were blown into the sound, some found refuge in unlikely spots. The sea grass may bounce back quickly, Eggleston says, but if not, the role of the alternative sites may become a factor for the state's number-one fishery next spring.

North Carolina Sea Grant researchers will assess many facets of the double punch of Hurricanes Dennis and Floyd, says Steve Olson, associate director for outreach.

"We are looking at a wide range of topics, including water quality, fisheries and ecosystems, aquaculture, seafood safety, coastal hazards and tourism," he says. ■



Near the opening of Jumping Run Creek, Bogue Sound is closed to shellfishing.

JUMPING RUN: BUILDING HOPE FOR CLOSED SHELLFISH BEDS

*By Renée Wolcott Shannon
Photographs by Scott D. Taylor*

Jumping Run Creek rises in southern Carteret County and runs toward the sea, sliding through brushy woodland and stands of live oaks, mobile home parks, back yards and businesses. Drainage ditches channel water to the creek, and it flows fast and clear, the color of tea. In the creek mouth, where Jumping Run empties into Bogue Sound, fat oysters and clams tempt diggers hungry for shellfish, but the beds are closed for all but a few dry days every year.

In Jumping Run, as in many coastal North Carolina watersheds, bacterial levels are dangerously high. Though the shellfish are otherwise healthy, they are contaminated by bacterial levels that can reach into the thousands per 100 milliliters in some tributaries. Counts of only 14 per 100 milliliters close a shellfish bed, while levels of more than 200 bacteria per 100 milliliters shut a creek down for swimming.

Continued

"Jumping Run is a fairly normal creek," says North Carolina Sea Grant water quality specialist Barbara Doll. "Creeks are this bad up and down the North Carolina coast."

Since 1998, Doll has been working with the Jumping Run Creek Shellfish Restoration Project, an effort to reduce bacteria in the stream and reopen shellfish beds.

Project collaborators include the N.C. Cooperative Extension Service, several departments and schools from NC State University, the Shellfish Sanitation Section of the N.C. Division of Environmental Health, Duke University Marine Lab and the Carteret-Craven Electric Cooperative (CCEC). Funds from a wide variety of sources, including the U.S. Environmental Protection Agency, the N.C. Wetland Restoration Program and the Clean Water Management Trust Fund, allow the collaborators to work on sites throughout the watershed.

By bringing together universities and government agencies, the project gains expertise, Doll says. While North Carolina Sea Grant and Duke University provide information about the coastal resources, and NC State extension leaders help with monitoring and land-use planning, Shellfish Sanitation "grasps where else this project could be applied," she says. "They know how much rain it takes to close a shellfish bed. They are out there in the field every day."

THE ROOTS OF THE PROBLEM

Compared to many urban areas, the watershed of Jumping Run Creek has only moderate development. Only 5 percent of the watershed's surfaces are impermeable to water, including parking lots, roads and rooftops. But the landscape is still far different than it used to be.

Years ago, Jumping Run wound through a pocosin forest or upland swamp, says Nancy White, extension associate professor and program leader at the NC State School of Design, who heads monitoring efforts on the creek. Spongy soils slowed the flow of water, but proved



too soggy to permit much development. The solution? Widespread ditching.

Like much of eastern North Carolina, the community along the banks of Jumping Run relies on drainage canals to speed runoff and prevent flooding. Straight ditches delineate the edges of fields and businesses, replacing wetlands and the gentle meanders of the stream's natural tributaries.

Unfortunately, the rapid drainage that is so convenient for property owners also has drawbacks. Where bacteria-laden water once filtered slowly through the pocosin's damp soils, giving the bacteria time to die off, it now flows directly into the creek. Bacteria from human and animal waste can flush from septic tanks and back yards to the mouth of the creek in a matter of hours, and when storms scour the landscape, even more bacteria flood the waterway.

The Shellfish Sanitation Section closes the shellfish beds to prevent humans from



TOP: J.D. Potts of the Shellfish Sanitation Section monitors water from a tributary to Jumping Run Creek.

CENTER: Potts watches runoff from Highway 24 flowing to Jumping Run.

BOTTOM: Eugene Clayborne, CCEC executive vice president and general manager, stands at the site of a future stormwater wetland.

ingesting pathogenic bacteria and viruses. Shellfish, which filter their food from the water, retain bacteria and viruses in their bodies. Eating contaminated shellfish can result in hepatitis, polio and typhoid.

Along North Carolina's coast, more than 56,000 acres of shellfish beds are permanently closed to harvesting as a result of high bacterial levels. This area nearly doubles after it rains, when temporary closures give shellfish time to flush the additional bacteria.

The White Oak River Basin, which

waters of Bogue Sound."

In addition, the watershed was not heavily developed and did not contain an obvious point source of bacterial loading. "It's a small watershed. Most of the potential sources are in a relatively small area — that will help us," Line says.

Problems at Jumping Run are likely to be mirrored at other coastal sites, so pinpointing the sources of bacterial contamination, and determining how each source contributes to the overall problem, is essential. Then, engineers like Doll can

history of the watershed," says Line.

Together, he and White work to produce an understanding of how and why bacterial levels have changed over time.

Since 1997, when the restoration project began, researchers have inventoried land uses along the creek, including residential neighborhoods, mobile home and recreational vehicle (RV) housing, an industrial facility and open space — fields, forest and swampland. Aerial photographs from the last three decades show how the land uses have changed over time, allowing speculation on how those changes might contribute to increases in bacterial loading.

In other fact-finding efforts, surveyors visually assessed septic systems for leaks, and found only two out of more than 50 that appeared to be suspect. Researchers also counted the numbers of outdoor pets and estimated the numbers of wildlife, since animal waste can contribute significantly to bacterial problems.

"Waste is like a time-release system for bacteria," says Doll. "Bacteria can live for a long time in that environment, and every time it rains, more get flushed into the creek through runoff."

Scientists also tested the creek itself for valuable data. By injecting dye into the creek at specific locations, researchers can determine how fast the water moves from tributaries to the main stem of the creek. Regular "grab" samples, or water dipped directly from the creek, allows routine monitoring for bacteria and other pollutants.

Additional storm samplers automatically collect water samples over the course of rain storms. When the samples are combined, they provide a snapshot view of any additional bacteria or pollutants washed into the creek by increased runoff.

The results from these monitoring efforts suggest that most of the bacteria come from residential areas and open spaces. After rainfall, bacterial counts were elevated in the creek's two residential tributaries. The culprits are most likely pet and wildlife waste and home septic systems, though researchers are not sure about the role septic systems play.

Continued



includes Jumping Run and portions of Bogue Sound, has a significant acreage of both permanently and temporarily closed waters. Jumping Run is a perfect site to demonstrate ways of limiting the amounts of bacteria reaching shellfish beds.

"We felt we could isolate the problems," says Dan Line, extension specialist with NC State's Department of Biological and Agricultural Engineering, who works closely with White. "Jumping Run was one of the first areas closed by Shellfish Sanitation, indicating that it's a major source of bacteria to the adjacent

choose water-control strategies to remedy the flow of bacteria-rich water at specific locations.

"The bottom line is, if you can't fix the bacterial problem in Jumping Run Creek, then you can't fix it anywhere," Doll says.

SEARCHING FOR CLUES

The Jumping Run Creek Shellfish Restoration Project takes advantage of long-term water-quality monitoring in the White Oak River basin, which has been collecting data on bacterial levels since the 1960s.

"We're trying to piece together the 30-year

Even when septic systems are functioning properly, some studies have shown that sandy soils allow up to 50 percent of the bacteria from a leach field to travel quickly more than 100 feet from the field. In the Jumping Run watershed, where septic systems are never far from drainage ditches, this bacterial mobility may present a serious challenge.

The creek's third tributary, next to the electric cooperative, complicates the issue by adding another pollutant to the mix — fresh water. "Bacteria live longer in fresh water than in salt, and it creates the wrong salinity for the oysters," Doll says. "It's almost an issue of habitat as well."

Slowing the rate of drainage into the creek is a top priority. The project's dye studies revealed that water from the tributaries reaches the main stem of the creek in hours rather than days, so that the shellfish at the mouth of the creek are always marinating in a stew of fresh water and bacteria. In a natural pocosin system, soils would trap and filter the water long before it reached the mouth of the creek, giving bacteria time to die and salt water time to move up the creek with the tide.

The ditches, which accelerate drainage by funneling water to the creek, are the villains in this scenario. Yet ditches have become an intrinsic part of the coastal landscape, allowing for roads, houses and other development. "You could plug all the ditches, but then people's yards would flood," Doll says. "You've got to convert the ditches to wetlands, or slow the water down before it gets to the ditches."

FINDING SOLUTIONS

To slow the rate of runoff, the project combines the expertise of engineers and land-use planners with the direction and enthusiasm of community members and volunteers. At a series of design workshops for watershed residents and businesses, the project collaborators are introducing the "best management practices" (BMPs) to improve water quality in Jumping Run Creek. They also seek guidance on where to place BMPs.

"Residents in the watershed help

decide where to put them, and they volunteer land," Doll says. Locals can also reveal things about the watershed that aerial photos cannot catch, like hidden ditches or a pond that's always filled with algae.

The CCEC, one of the project's local collaborators, is already working with the N.C. Wetlands Restoration Program to

Conrad hopes the results of the stormwater wetland will reach far beyond filtering the water, though he looks forward to digging clams if the project is a success. Working with a National Wildlife Federation venture, Wildlife and Industry Together, the CCEC plans to make the wetland a community focal point and an outdoor classroom for local schools.



convert five acres of ditched land on its industrial site to stormwater wetlands. "I can't say enough about the cooperation and help we've gotten from them," Line says.

The restored wetlands will consist of wide, shallow trenches planted with trees and flowering plants that flourish in wet earth. Water draining off parking lots, lawns and roadways will be diverted to the wetlands, where the roots of the plants will filter out pollutants and nutrients. Perhaps most importantly, the wetlands will slow the flow of fresh water to Jumping Run Creek.

"We're real excited about being a part of this project," says Craig Conrad, vice president of engineering and operations at the electric cooperative. "We know the importance of water quality, and we're happy to do our part to help clean up our water."

Ultimately, the wetlands will feature boardwalks and signs that will allow students and other visitors to identify wetland foliage and wildlife. The CCEC will encourage wild creatures to settle in the wetland by planting cedars and other trees and installing bluebird boxes and martin houses, Conrad says.

Extensive stormwater wetlands are not the only options available to nearby residents. Rain gardens are similar, smaller constructions used to trap and filter water — small basins filled with gravel, sand, organic soil and plants. Parking lot medians and other raised plantings are easy to convert into picturesque rain gardens.

Grassy swales are another simple water-treatment method: wide, shallow pathways lined with grass. As water runs slowly through a grassy swale, pollutants



settle out or leach into the soil for treatment. Low "check dams" placed across the swale can slow water even further.

Permeable pavements, which combine concrete or plastic grids with sand, rock and soil, allow water to pass through them and seep into the ground. Though they are not as strong as conventional roadways, permeable pavements can easily be adopted for use in overflow parking lots, driveways and emergency lanes.

HOPE FOR THE FUTURE

Tom Singleton, who attended a Jumping Run community design workshop in September, is eager to get involved with the project. Singleton owns and operates Water's Edge RV Park, a 13-acre campground on Bogue Sound. "Every time the shellfish beds are open, my people like to go out there and look for clams," Singleton

says. "It's part of the campground. I'd love to see it be better."

Like many other coastal residents, Singleton has a ditch on his property that drains into a swamp alongside Jumping Run. Singleton hopes the restoration project will help him enhance the wetlands on his property. "One of the things they said at the workshop is that you can have a sick wetland," he says. "If I'm going to have wetlands on my property, I want them to be the best ones around."

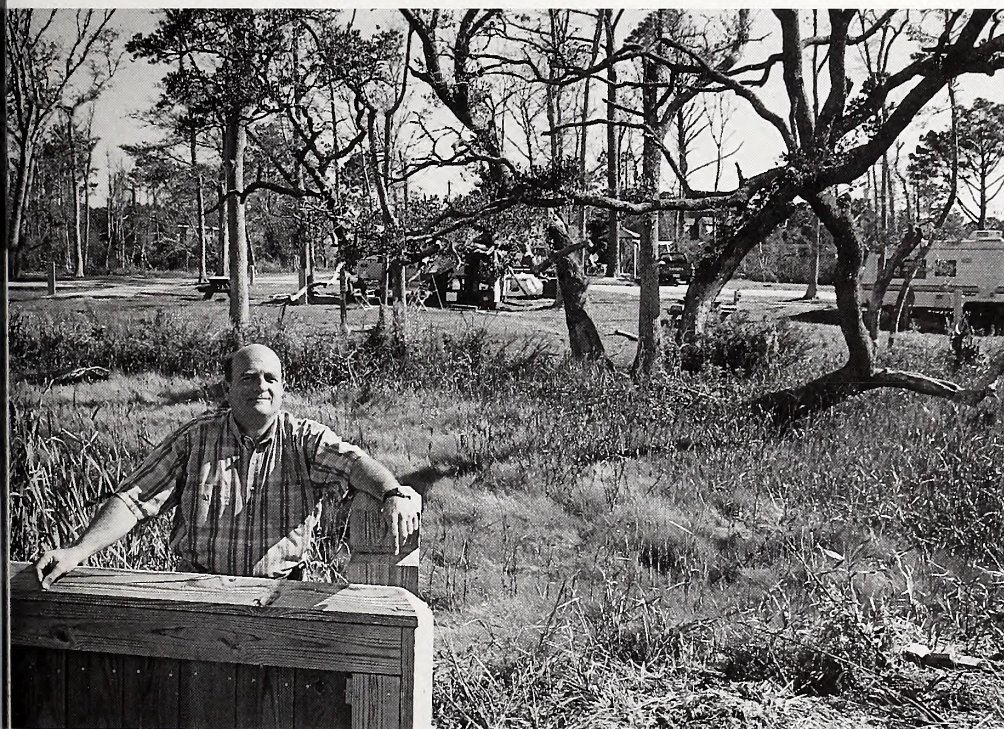
Preston Pate, director of the N.C. Division of Marine Fisheries, is also quick to praise the restoration project. Jumping Run Creek runs through his back yard, and he recommended the watershed for the project "because it lent itself very neatly to the experimental phase of the planning. ... It's a real diverse but discrete system to work with."

With 18 percent of the state's shellfish beds considered permanently closed, communities up and down the coast will be tracking the outcomes of the Jumping Run Shellfish Restoration Project. "There's the potential for applying that technique to other areas if it proves to work here," Pate says.

If the project works as planned, Jumping Run could see reduced bacterial levels by the end of this shellfishing season. In spring, the CCEC will be planting wetland vegetation and installing bird-houses. Other landowners will be tending rain gardens and grooming grassy swales.

If all goes well, when the holidays roll around next year, homeowners along Jumping Run Creek may be making oyster stuffing and clam chowder from shellfish gathered in their own back yards. ■

For more information on Jumping Run Shellfish Restoration Project, call Barbara Doll at 919/515-5287. To get a copy of the award-winning Coastal Water Quality Handbook, which describes runoff, pollution and water quality in greater detail, call the North Carolina Sea Grant office at 919/515-2454, or mail a check for \$6 to North Carolina Sea Grant, NC State University, Box 8605, Raleigh, NC 27695-8605. Write UNC-SG-97-04 in the memo line.



TOP: From the bridge at Barnesfield, Jumping Run Creek flows south between bulkheads to Bogue Sound.

CENTER: Water leaving Water's Edge RV Park flows through these cattails near Jumping Run Creek.

BOTTOM: Tom Singleton hopes the Jumping Run project will help him enhance the wetlands encircling his campground.

Dynamic Inlets:

The Changing Shape of North Carolina's Coastline

By Katie Mosher
Photographs from
Shifting Shorelines:
A Pictorial Atlas of
North Carolina Inlets

To many coastal visitors, North Carolina's barrier islands define the state's coastline, with each island offering a unique personality.

The inlets separating the islands — and linking the protected sounds to the open ocean — are often overlooked.

But coastal residents and geologists alike know the power and influence that the inlets have had on North Carolina's coastal history. Each year during hurricane season and on into the winter nor'easters, they ponder the possibility: Will a storm move enough water to cut a new inlet, or enough sand to close an existing one?

In fact, inlets can influence shoreline erosion and accretion for up to a mile on either side of the channel, explains William J. Cleary, a North Carolina Sea Grant scientist at the University of North Carolina at Wilmington.

"Inlets are part of a sand-sharing system. They are not just places where water goes in and out," adds Cleary, author of *Shifting Shorelines: A Pictorial Atlas of North Carolina Inlets*.

The book — co-authored by Tara P. Marden, who received her master's degree

from UNC-W — looks at each of the state's 22 inlets, from Oregon Inlet in the northern Outer Banks to Mad Inlet near the South Carolina line. Each inlet is documented with six chronological aerial photographs and a short history.

While coastal residents easily note even subtle changes in the inlets, visitors may only notice when rapid erosion threatens a building.

The new book gives historical perspective on the inlets' dynamics, including the impact of major storms.

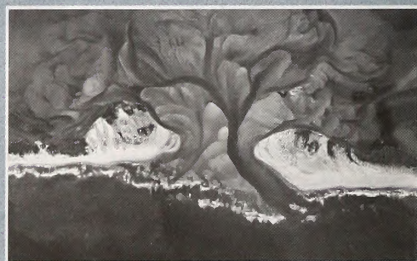
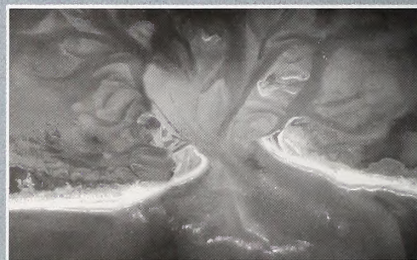
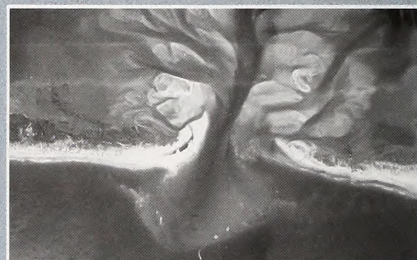
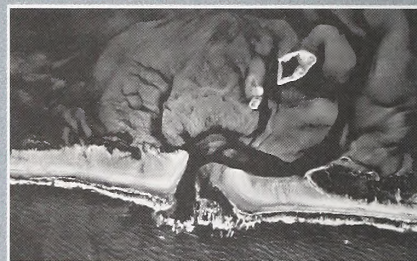
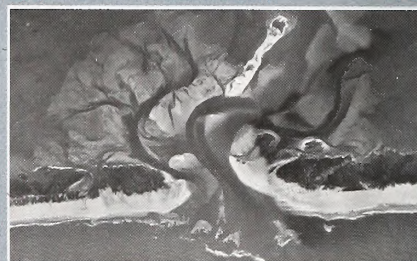
"Inlets widen and constrict with the passage of storms," Cleary says. "Typically during storms the inlets tend to widen and then return to a balance."

For example, the surge associated with Hurricane Hazel in 1954 widened Mad Inlet to its maximum width of 230 meters. Over time, the inlet narrowed again, until it closed in 1997.

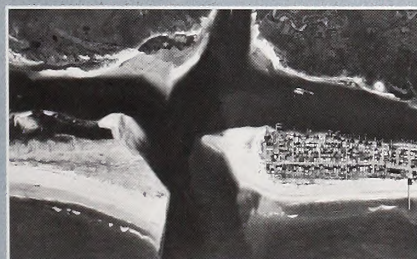
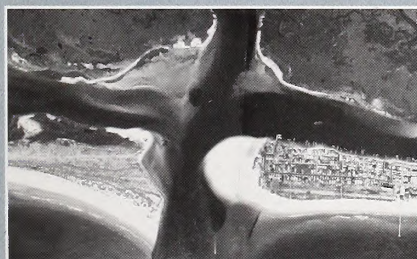
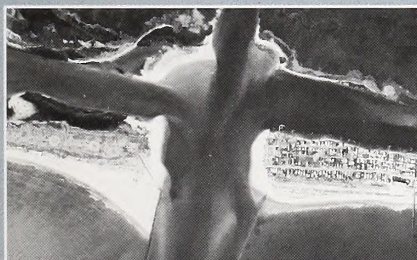
Oregon Inlet reached a maximum width of 2 kilometers following the Ash Wednesday storm in 1962. The same storm dramatically widened Old Topsail Inlet.

Old Topsail Inlet had narrowed to the point where it was partially closed in the

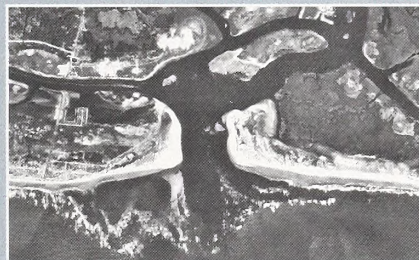
Drum Inlet
from 1945 to 1996



**Masonboro Inlet
from 1938 to 1996**



**Shallotte Inlet
from 1949 to 1996**



SEA SCIENCE

mid-1990s, but Hurricanes Bertha and Fran reopened the inlet to a width of 53 meters in 1996. Just two years later, the inlet was closed again.

Hurricanes Bertha and Fran left their marks on other southern inlets as well, including Carolina Beach Inlet and New Inlet.

Other storms have sent great amounts of water cresting over the oceanside dunes, but have not actually cut new inlets. Such was the case with Hurricane Dennis, which battered the Outer Banks earlier this year, wreaking havoc for Hatteras Island residents and tourists and forcing state officials to consider new options for N.C. 12.

Throughout history, inlets have served as gateways to commerce and adventure. In more recent decades, inlets' mercurial natures have become the bane of developers and property owners who have built dream homes or resorts along the fragile barrier islands. The best-known example has been Mason Inlet's migration toward the Shell Island Resort near the tip of Wrightsville Beach.

"Mason Inlet moved over 365 feet in a year, averaging over one foot per day," says Spencer Rogers, North Carolina Sea Grant's coastal construction and erosion specialist. "Others have moved over 1,000 feet in a single year."

The inlets reflect nature's volatile side. While tidal currents constantly attempt to deepen an inlet's channel, ocean waves transport sand into the inlet, filling it again. Inlets change as the balance between these forces shifts.

"Inlets are the most dynamic coastal features," Rogers says. ■

To order a copy of Shifting Shorelines: A Pictorial Atlas of North Carolina Inlets, send a check for \$15 to North Carolina Sea Grant, NC State University, Box 8605, Raleigh, NC 27695-8605. Ask for publication UNC-SG-99-04.

Catch and Release:

Circle Hooks Round Up Giant Tuna... And Let Them Swim Away Again

By Renée Wolcott Shannon

It's November, and once again fishers are scanning the waters off Morehead City and Hatteras for a fish that has become an annual visitor: the giant bluefin tuna. Though the bluefin tuna recreational season does not start until Jan. 1, catch and release of the monster fish has become big business in the coastal counties. As a result, many anglers have added circle hooks to their arsenals of fishing gear.

Originally used in the longline fishing industry, circle hooks have caught on with recreational users because they do little damage to fish. The unusual circular shape actually prevents the fish from swallowing the hook and getting injured internally. Fishers theorize that the fishing line pulls the hook back out of the fish's throat, to lodge firmly in the corner of the jaw when the fish turns. Anglers don't even need to "set" the hook by jerking the line, as they do with the ubiquitous "J hooks."

"You look at that hook and you say, 'There is no way a fish can get caught on that,'" says Jim Bahen, North Carolina Sea Grant's recreational fishing specialist. But it works almost every time, catching tuna, snapper, grouper and tarpon right in the hinge of the jaw, where the hook can easily be removed and retrieved.

Fishers and scientists are now studying the hook's usefulness with different species of fish, and so far, the results are promising. Hard-mouthed reef and ground fish were already known to show high survival rates using circle

hooks, and preliminary work with flounder suggests that they, too, respond well to the hooks. Other studies are focusing on billfish, Pacific halibut, red drum and striped bass.

Circle hooks' performance with the catch and release of tuna is already well known, increasing the number of fish hooked in the lip to about 90 percent. If you plan on eating your catch this spring, however, you need more than just a circle hook.

One important thing to remember is that Atlantic bluefin tuna are internationally protected, so killing one requires a current permit from the National Marine Fisheries Service (NMFS). You'll also need to find out if the quota is still open for your gear category. See the NMFS tuna Web site at www.usatuna.com for more information or to print out a permit application.

Whether you plan to catch and release your tuna or eat it, you need to have the appropriate gear. Atlantic bluefin tuna are large, fast fish and require heavy equipment and a specialized approach. Circle hooks don't work well with bait that is dragged through the water, Bahen says, so most fishers chum or "chunk" for tuna, throwing chopped menhaden or other fish into the water until tuna are feeding vigorously. Similar

chunks threaded onto circle hooks will then catch some of the tuna off guard.

Because tuna are such huge fish — tuna weighing more than 600 pounds have been caught off the North Carolina coast — you must use a large hook to catch them. Bahen recommends a 12/0 to 16/0 circle hook, and suggests matching the line strength to the hook size. For a 12/0 hook, he uses 150-pound line, while a 16/0 hook demands a beefier 350-pound line.



Jim Bahen shows Carlos Fetteroff how to use the heavy fishing gear.

Scott D. Taylor



Researchers prepare to tag a giant tuna.

The tackle also has to be very heavy. "You can't go bear hunting with a switch," Bahen cautions. "Smaller tackle will kill the fish. They'll fight longer, and by the time you reel them in, they'll be so tired that it takes longer to resuscitate them, and some mortality can occur." For battling giant tuna, he recommends 130 International reels, or other big reels capable of holding 150-pound-test line.

The rods must also be mammoth: unlimited class, the biggest rods that still have line guides on them. Bent-butt rods allow the end of the rod to lie closer to the water, decreasing the effort required to bring in the fish. When fishing for Atlantic bluefin tuna, anglers are strapped to both their rods and their chairs, so the giant fish cannot pull them overboard.

To pull in such a feisty fish, Bahen uses a 700-yard main line of 130- to 150-

pound nylon or Dacron, which has very little stretch and lies flat on the reel. Attached to the main line is a "top-shot" of 300 to 400-pound monofilament, followed by an 800-pound snap swivel. Bahen has also experimented successfully with the new fluorocarbon line as an invisible leader. Though expensive, the fluorocarbon is popular for making the circle hook and bait more inconspicuous to the fish.

This year, fishers have two chances to explore

catch-and-release tuna fishing. Bahen, who serves on the steering committee of the first National Symposium on Catch and Release in Marine Recreational Fisheries, urges anglers to attend. "We really want to emphasize catch and release. It's easy to catch more than you need."

The symposium, to be held Dec. 5-8 in Virginia Beach, Va., will address hook and release mortality, fisheries-management issues, angler behavior and recreational fishing ethics. In one session, presenters will focus on fish catching, handling, tagging and release practices that significantly affect fish survival.

North Carolina fishers may be particularly interested in new research findings on the use of circle hooks in tuna, billfish, sharks, striped bass and summer flounder. Other topics include fish landing and handling stress, swim bladder expan-

sion problems, terminal tackle and other gear options.

Charter captains, fishing tournament organizers and club leaders are encouraged to attend. Because the symposium will address fish-discard mortality with the use of rod-and-reel gear, representatives of the commercial hook-and-line fisheries may be interested as well.

For fishers who actually want to get out on the water, this year also marks the third annual Tag-A-Giant project, an effort to coordinate anglers and scientists in the study of bluefin tuna. In past years, after an angler reeled in a tuna, surgeons implanted an archival tag in its body cavity. The tag, equipped with a microprocessor, gathered information on the fish's activities until it was captured again and the tag was returned.

This year, "We're moving to a new style of pop-up tag," says Bill Hitchcock, director of Tag-A-Giant. "A larger class of fish will also be tagged this year."

The pop-up satellite tags, which detach from the fish after a specified length of time, record information about the tuna's depth, location in the ocean, and internal and external temperatures. This data will be important in future management decisions.

In past years, returned data from a simpler generation of satellite tags indicated that a large percentage of the tuna captured off Hatteras and Morehead City live to swim another day, happy news for conservation anglers. ■

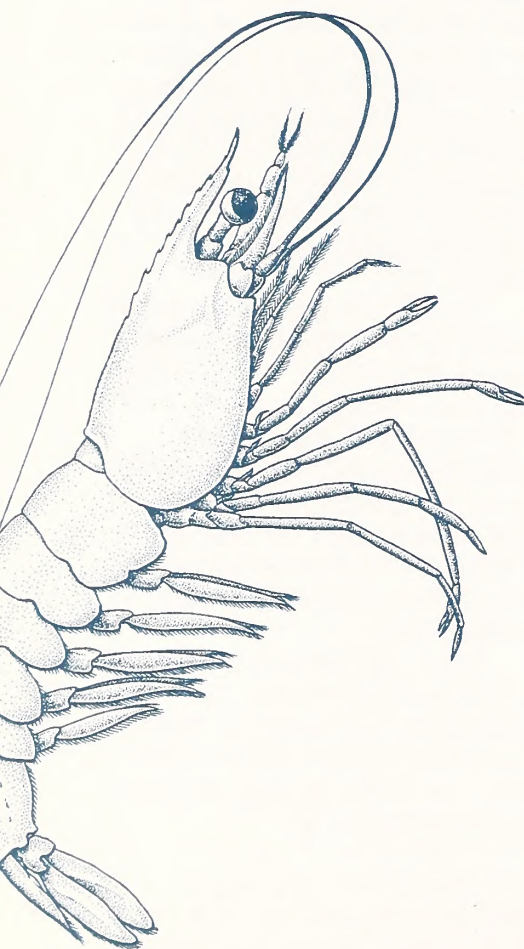
For more information about the National Symposium on Catch and Release in Marine Recreational Fisheries, call Jim Bahen at 910/256-2083 or Jon Lucy, Virginia Institute of Marine Science, at 804/684-7166. You can also email Lucy at lucy@vims.edu or see the symposium's Web site at www.vims.edu/adv/catch.

For more information on Tag-A-Giant, see the program's Web site at www.tunaresearch.org/tagagiant.html or contact Bill Hitchcock at 252/223-2066.

Holiday Festivities:

Fish, Shrimp and Oysters Brighten Traditional Meals

By Katie Mosher



Holiday meals are special times. Seafood dishes are traditional fare not only at the coast, but also for many inland families who prefer the taste and quick preparation time of fish and shellfish.

To help you prepare for the 1999 holiday gatherings — and to ring in the year 2000 — we dipped into the *Mariner's Menu* archives. The following recipes were developed by Joyce Taylor, who retired in 1997 as North Carolina Sea Grant's seafood education specialist.

Cruise through the selection and try one or all. We offer an appetizer and a pilaf featuring shellfish, as well as two fish entrees.

And for those who want a splash of seafood with their turkey dinner, we offer recipes for oyster dressing and gravy.

FESTIVE SEAFOOD SPREAD

- 1 pound backfin crabmeat
- 1/2 pound cooked shrimp
- 1/2 cup mayonnaise
- 1/2 teaspoon freshly ground white pepper
- 1/8 teaspoon paprika
- 2 teaspoons chopped fresh parsley
- 1/4 teaspoon Tabasco sauce

Remove any cartilage or shell from crabmeat. Chop shrimp coarsely. In medium bowl, combine crab, shrimp, mayonnaise, pepper, paprika, parsley and Tabasco. Chill well. Serve with assorted crackers. Makes about three cups. Spread may also be heated over boiling water and served hot.

CREAMY FISH WITH CRANBERRY SAUCE

- 1 pound skinless flounder (or other lean) fillets
- 2 tablespoons margarine
- 2 tablespoons flour
- 1/2 teaspoon salt
- 1/2 teaspoon dried thyme
- 1/4 teaspoon freshly ground white pepper
- 1 cup milk
- 2 tablespoons dry sherry
- 1/2 can whole-berry cranberry sauce

Melt margarine in medium skillet over medium heat. Stir in flour, salt, thyme and pepper. Gradually stir in milk and sherry. Cook, stirring constantly, until thick and smooth.

Cut fish into serving-size pieces. Salt lightly. Add to mixture in skillet. Heat to boiling. Reduce heat to simmer. Cover and cook until fish flakes easily with a fork, about 10 minutes. Carefully lift fish onto platter. Spoon sauce over fish. Surround with cranberry sauce. Serves 4 to 6.

ELEGANT HOLIDAY FLOUNDER

- 2 pounds skinless flounder (or other lean) fillets
- 1/4 pound shrimp, peeled and chopped
- 1 1/2 tablespoons margarine
- 2 tablespoons flour
- 1 1/2 cups half-and-half cream
- 3/4 teaspoon salt
- 1/4 teaspoon freshly ground white pepper
- 1/8 teaspoon nutmeg
- 3/4 cup sour cream
- 1 1/2 cups cooked rice
- 1/2 cup toasted slivered almonds
- 1/4 cup chopped fresh parsley
- paprika

Melt margarine in medium saucepan over medium heat. Stir in flour and mix well. Add cream gradually, stirring constantly. Add salt, pepper and nutmeg. Cook, stirring constantly, until thick. Stir in sour cream and shrimp. Remove from heat.

Reserve half of shrimp sauce for topping. Combine remaining sauce, rice, 1/4 cup almonds and parsley. Spread over bottom of well-greased 12x8x2 baking pan. Cut fish into serving size portions. Arrange fish over rice mixture. Spread reserved shrimp sauce over fish. Sprinkle with 1/4 cup almonds and paprika. Bake at 350 degrees for 35 to 40 minutes or until fish flakes easily. Serves 6 to 8.

OYSTER-MUSHROOM DRESSING

- 1 pint standard oysters
- 1/2 cup margarine
- 1 pound coarsely chopped fresh mushrooms
- 1 1/2 cups chopped celery, including leaves

- 1 cup chopped onion
- 2 cups toasted bread cubes
- 1/4 cup chopped fresh parsley
- 1/2 teaspoon salt
- 1 1/2 teaspoons poultry seasoning
- 1/4 teaspoon freshly ground black pepper
- 2 eggs, beaten

Drain oysters. Melt margarine in large skillet over medium heat. Sauté mushrooms, celery and onion until tender. Place in large bowl. Stir in bread cubes, parsley, salt and poultry seasoning. Add eggs and oysters and mix thoroughly. Place in well-greased baking dish. Bake at 350 degrees for 20 minutes or until done in center and lightly browned. Makes about 6 cups.

OYSTER-MUSHROOM GRAVY

- 1 pint standard oysters
- 6 tablespoons margarine
- 3 cups sliced fresh mushrooms
- 1/4 cup margarine
- 3 tablespoons flour
- 1/4 cup finely chopped green onion, including tops
- oyster liquor plus enough chicken broth to make 2 cups
- 1/4 cup dry white wine
- 1/2 teaspoon Worcestershire sauce
- 1/4 teaspoon salt
- 1/4 teaspoon freshly ground black pepper
- 2 tablespoons chopped fresh parsley

Melt 6 tablespoons margarine in large skillet over medium heat. Sauté mushrooms until tender. Remove with slotted spoon and set aside. Discard liquid.

In same skillet, melt 1/4 cup margarine over low heat. Stir in flour and cook, stirring constantly, until roux is rich brown, about 10 to 15 minutes. Add onion. Blend in broth and wine. Simmer, stirring

constantly, until thickened. Stir in Worcestershire, salt and pepper. Return mushrooms to skillet. Add oysters and bring to simmering point. Simmer until oysters are desired doneness. Remove from heat and stir in parsley. Makes 3 to 4 cups.

SHRIMP PILAF

- 1 pound medium shrimp, peeled and deveined
- 4 slices bacon
- 1/2 cup finely chopped celery
- 2 tablespoons chopped green pepper
- 1 tablespoon flour
- 1 1/2 teaspoons salt
- 1/8 teaspoon freshly ground black pepper
- 1/4 cup Worcestershire sauce
- 1 tablespoon margarine
- 1 cup uncooked regular rice
- 2 2/3 cups water

Fry bacon in medium skillet over medium heat. Remove bacon, crumble and set aside. Reserve 2 tablespoons bacon drippings in skillet. Sauté celery and green pepper until tender.

Combine flour, salt and pepper. Dredge shrimp in mixture and add to skillet. Stir in Worcestershire. Cover and cook over low heat for 10 minutes, stirring occasionally.

Melt margarine in medium saucepan over medium heat. Add rice. Cook over low heat until lightly browned, stirring constantly. Add water and bring to boil. Reduce heat and cover. Simmer 20 minutes or until tender. Stir rice into shrimp mixture and remove from heat. Sprinkle with crumbled bacon. Serves 4 to 6. ■

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